Model Engineer

THE MAGAZINE FOR THE MECHANICALLY MINDED

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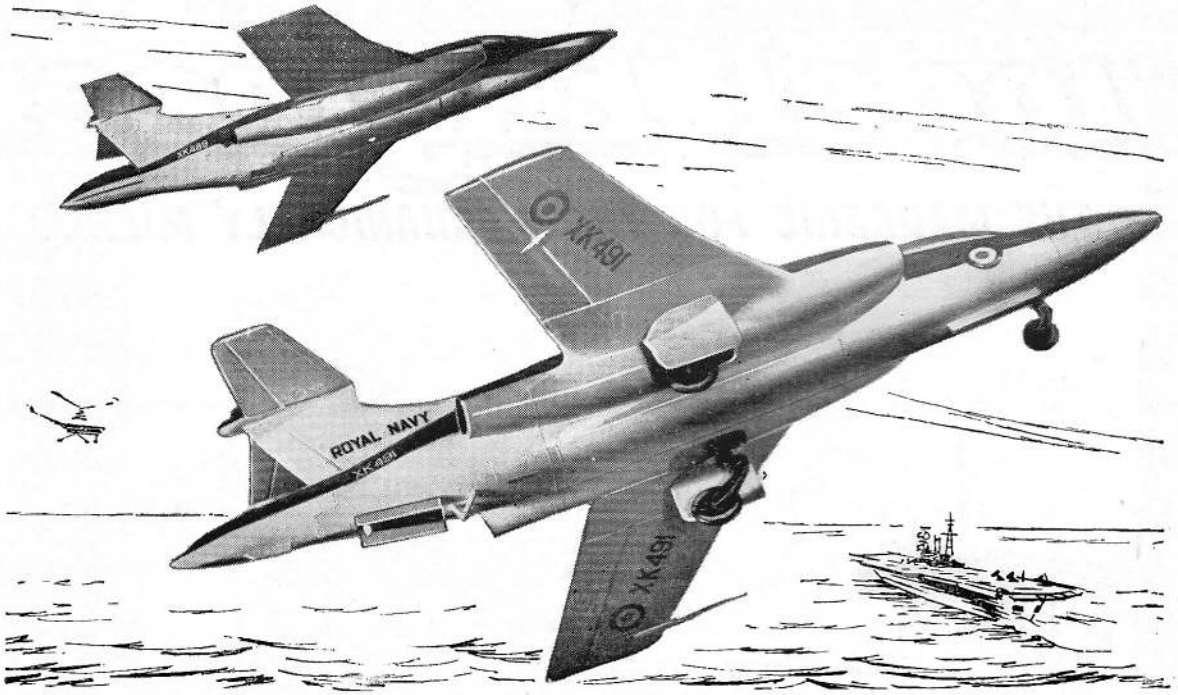
ONE SHILLING 2 MARCH 1961 VOL 124 NO 3112



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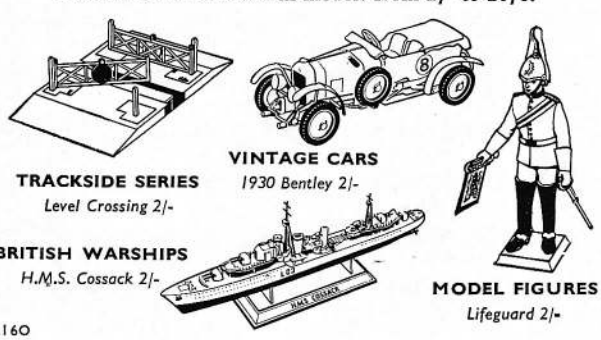

A.160

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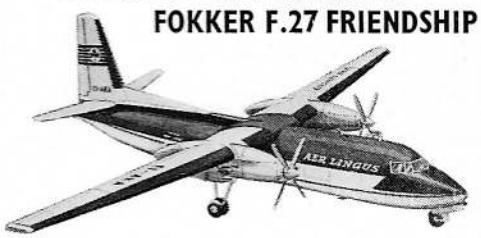

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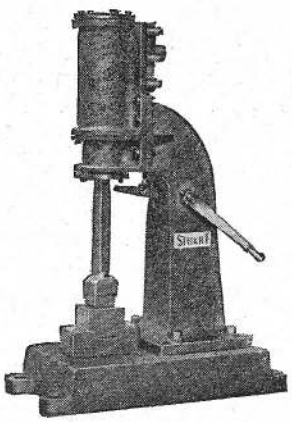

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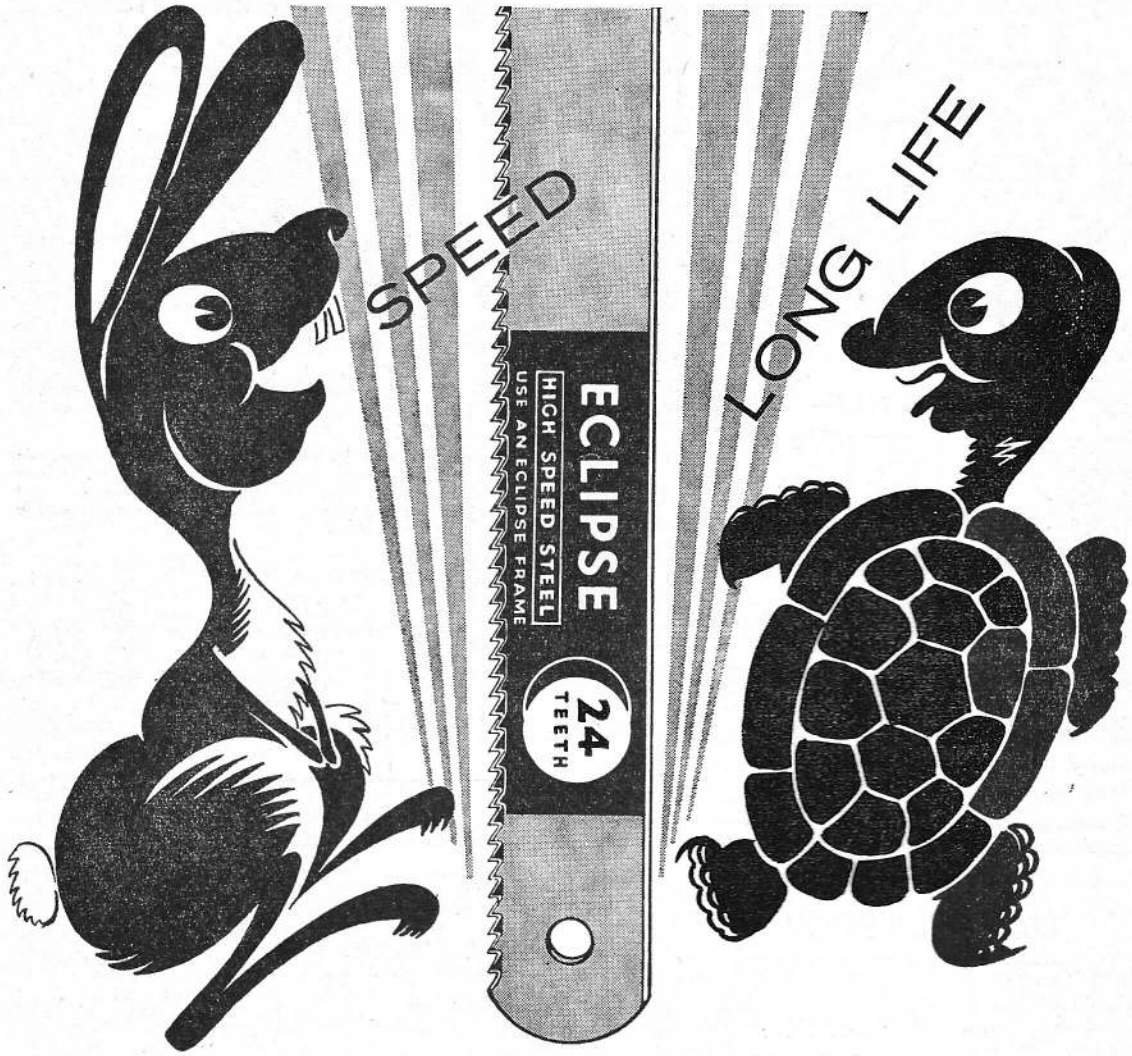

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Model Engineer

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IN THIS ISSUE

Smoke Rings	251
High speed boats ...	253
Mysteries of the magneto	256
Workshop hints ...	259
Sentinel—Easiest way to fit cross-tubes	260
Steam on the mountain	263
Black Sand—Four hours from Dante	264
Library of Locomotives—Their names were taken away	266
Machine saw for schools—It can help to make itself	268
Proud of the Pacifics ...	271
Moorcock—Forward to the funnel	272
Keeping to plan ...	275
Readers' queries ...	276
Postbag	278
Club news...	281

COVER PICTURE

Wroxall, *an* E1 *class* 0-6-0T, *was the last of its type to serve on the Isle of Wight. In "Library of Locomotives," pages* 266-7, *Robin Orchard concludes his notes on the old Brighton engines.*

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A WEEKLY COMMENTARY

Smoke Rings

By VULCAN

WHEN enthusiasts hear that an interesting old narrow-gauge locomotive is to be broken up, they usually make some effort to raise funds to preserve it. But what happens in other countries ?

Mr Pat Flecker, a hospital superintendent of Mareeba, Queensland, heard that a sugar mill, some 50 miles away, had no further use for its 2 ft gauge 0-6-0 tank. So he drove over and asked if he could have it. "Take it away," they said.

That was how this fascinating tank with its spark-arrester chimney and Walschaerts valve gear came to adorn the local park.

Transport was by low-loader, though Mr Flecker told me, when he called at Noel Street while in Britain on business, that he felt some trepidation about the low-loader's ability to haul the heavy little tank up the 1,300 ft range approaching the park. However, the incline proved within the capabilities of the vehicle.

Still running well

I was interested to hear him tell about an ambulance which is run by the Queensland Railways in association with Mr Flecker's hospital.

The engine and chassis were once the basis of a 1916 AEC bus. When its days as a passenger vehicle were over it was fitted with train wheels, the front axle was removed and replaced by a bogie so that it would traverse tight curves down to 16 chains, and then it was set on rails.

Its purpose is to transport patients between the hospital and station during the wet season when travelling is difficult by road.

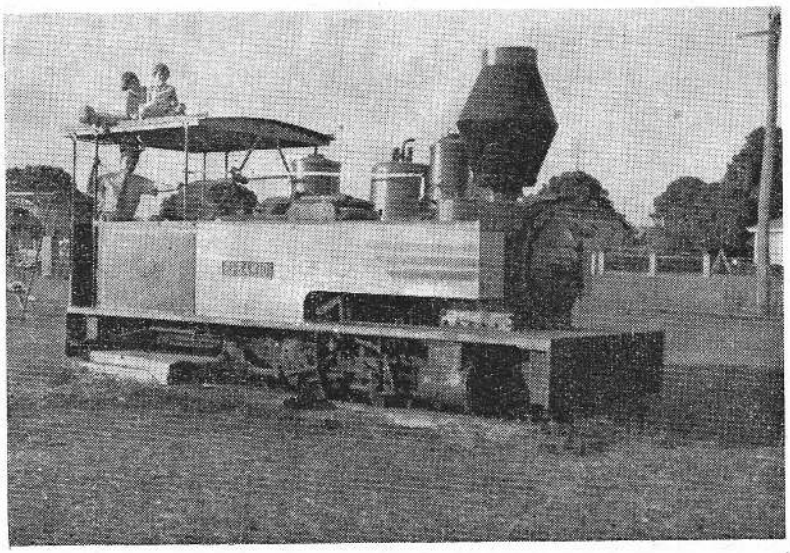
The engine is the original and is in excellent condition. Maintenance is carried out by the railway company, who treat this vintage vehicle as a pet.

Almost invariably it starts on the first pull, said Mr Flecker.

Film about steam

SECRETARIES of clubs with a live-steam interest are constantly looking for interesting films with which to entertain their members.

I am pleased to tell them about a new film by Shell-Mex and BP Ltd which will be available from June 1. It is the second in the Industrial Notebook series and is a miscellany



Resting peacefully in a Mareeba park, this 0-6-0 *narrow-gauge tank was once the motive power unit at a sugar mill*

of items about the iron and steel industries.

As every schoolboy knows, these industries have been intimately associated with steam ever since the first colliery cage was hauled to the surface by that power. Their association with railways dates back even further, for the first horse drawn lines were laid for the conveyance of coal and iron.

Not surprisingly then the film shows the development of railway metals, from the very early type cast in 1767 to modern bull-head welded into lengths of 300 ft.

Those who delight in the majesty of the old beam engine will thrill to the sight of the four engines still in use at Leicester Sewage Works. The 8-ton flywheels of these monsters, rated at 200 i h.p., turn at a stately 11 r.p.m.

The powerful three-cylinder steam engine at Dorman Long's Britannia Mill, with its fantastic acceleration, is included as an interesting comparison.

Not all minerals are excavated underground; with the introduction of the giant dragline large quantities are won from the sub-strata after the over burden has been removed.

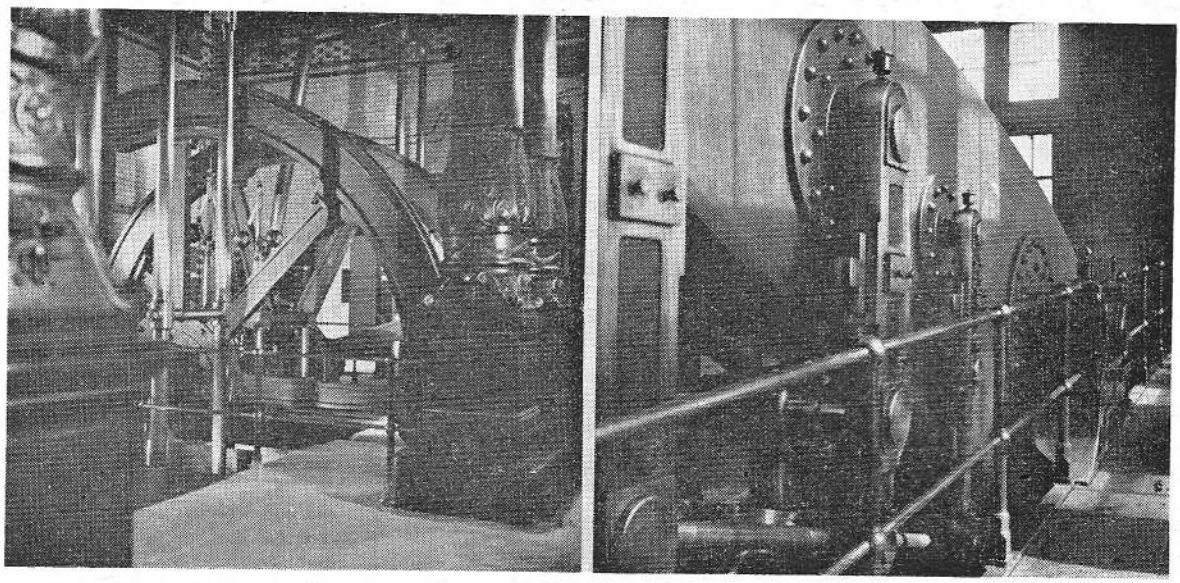
The film shows the big dragline in operation at Corby, where ironstone is being excavated. Its enormous 27-ton bucket scoops material in hippopotamus bites at the rate of 1,600 tons an hour.

The film may be borrowed from the Shell-Mex and BP Film Library from June 1. It is available in two sizes, 35 mm. and 16 mm. At the standard rate of 24 frames per second it takes nearly 28 minutes to pass through the projector.

Incidentally, from HM Stationery office, one can buy a little booklet, *Films for Industry*, which lists the industrial subjects one may hire from the Central Film Library. It can also be had through a newsagent.

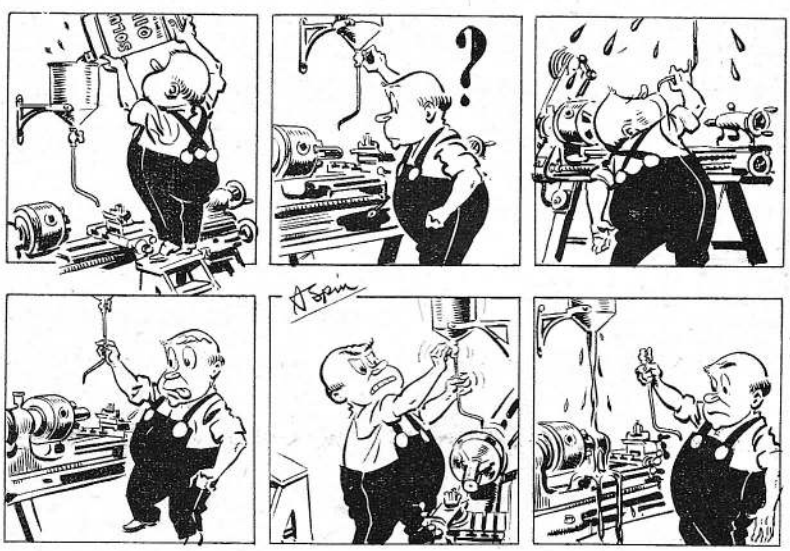
Next week

In the issue of March 9, a well-loved feature returns to MODEL ENGINEER. *When Mr Maskelyne died suddenly last year he left a short unpublished series of "Locomotives I Have Known." The first of these posthumous papers will appear next week.*



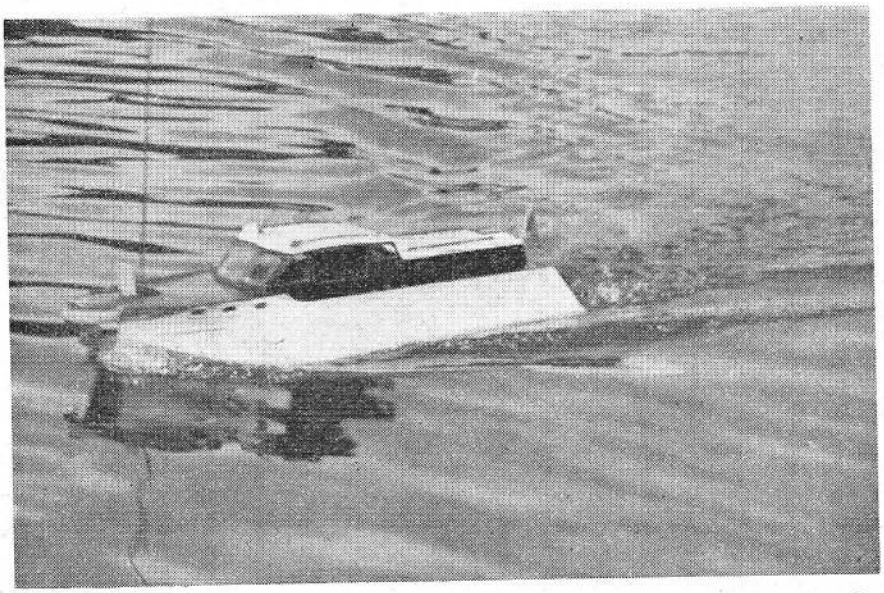
Two views of one of the majestic beam engines at Leicester Sewage Works, which are featured in the new Shell-Mex BP film

CHUCK . . . **. . . THE MUDDLE ENGINEER**



HIGH SPEED with RADIO CONTROL

LEONARD CASSANET explains how hulls behave in the water



Wave formation on a displacement hull—not perfect, but fairly accurate although the boat is incorrectly trimmed

RADIO-CONTROLLED boating is concerned mainly with two types of hull. The most popular is the hand chine V-bottomed hull, and the other is the round-bilge displacement type.

Displacement means that the hull will displace a weight of water equal to the total weight of the hull. When the hull is driven through the water, the amount of water it displaces is pushed aside and forms waves. A displacement hull is sometimes referred to as a wave-making hull.

There is an optimum speed at which a hull can be driven, most easily and economically—the speed at which it encounters least resistance. A boat may be said to have reached it when the wave formed at the bows is at its peak near the bows, and the wave formed at the stern is at its lowest, as in Fig. 1.

Mathematically speaking this condition should be reached when $\frac{V}{\sqrt{L}} = 1$; when V is the speed in knots, and L the length of the hull in feet. As an example from full size, $V = 7$ knots $L = 49$ ft and $\frac{7}{\sqrt{49}} \left(\text{or } \frac{7}{7}\right) = 1$.

This is all very interesting, you may say, but what about high speed work? Well, it is important to understand the $\frac{V}{\sqrt{L}}$ theory, especially when you are contemplating a new model.

For high-speed work, the best hull form evolved so far is the V-bottomed hard chine, as it will plane at a much lower speed than a round bilge. Edgar T. Westbury has given a very full explanation of planing in his series on hydroplanes and I suggest that you refer to it.

Reducing skin friction

The great enemy of speed on water is the resistance or skin friction of a hull. There are, of course, many obvious ways of reducing it, such as superior finish, variations of form, and—most important of all—reduction of wetted areas. A hull is said to be planing when the immersed section ceases to displace an amount of water equal in weight to the all-up weight of the hull. To achieve this condition, it is necessary to increase the speed of the boat until it is driven towards the surface by the increased thrust of the propeller. When the thrust is sufficient, the forward portion of the hull unsticks from the surface. It is then planing.

Fig. 2 shows a typical hull section with a sharp V at the bows, which incidentally assists in turning at high speed. The sharp V has one fault which is important in radio-control work; there is not a great deal of buoyancy in the forward sections, so that when we run into rough water, as we very often do, the V will tend to slam the waves because the sharp V cuts them and the main body of the wave hits the hull roughly amidships.

If you refer to Fig. 3, you will see that the sections below the chine have been given some convexity and that the chine line has been lifted a little higher. This gives a much more buoyant section and allows the hull to ride across the waves, breaking them up and throwing the water away from the hull.

It has been established that the ideal planing angle is about $3\frac{1}{2}$ deg. The resistance at this angle is about 2/17ths of the weight of the boat.

To make a hard chine hull plane at all, its static trim must be correct. This is shown in Fig. 4. Of course, it will vary with differing hulls, but the essentials are there. The chine line should be comfortably above the water line at the forward end and not

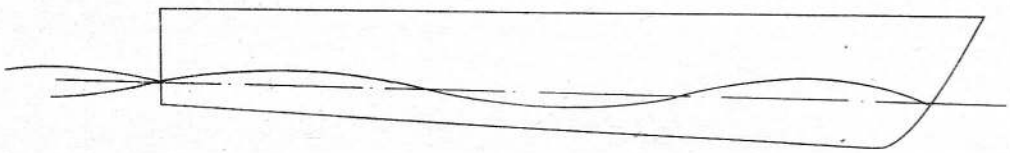
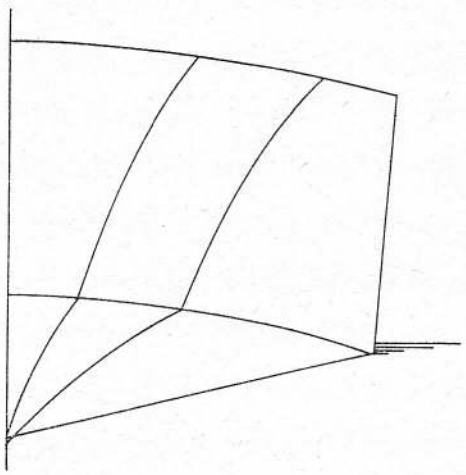
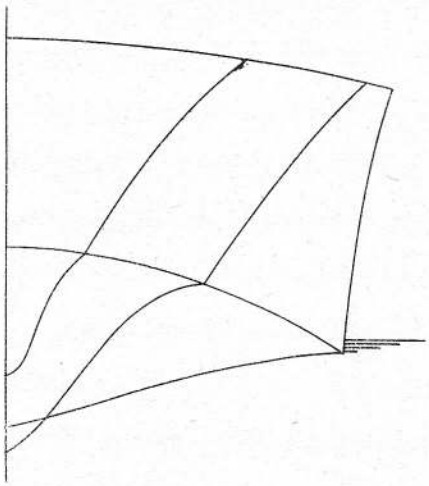


Fig. 1: *Correct waveform of displacement hull*





Left, Fig. 2: *Sharp V hull form. Right, Fig.* 3: *Hull form with improved buoyancy in the forward sections*

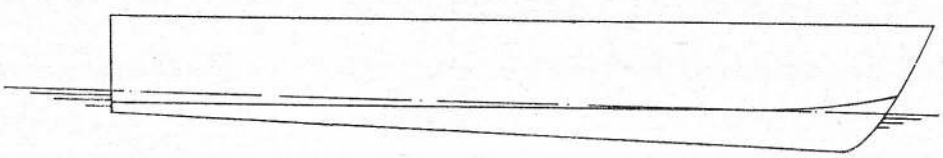


Fig. 4: *Approximate static trim of hard chine hull*

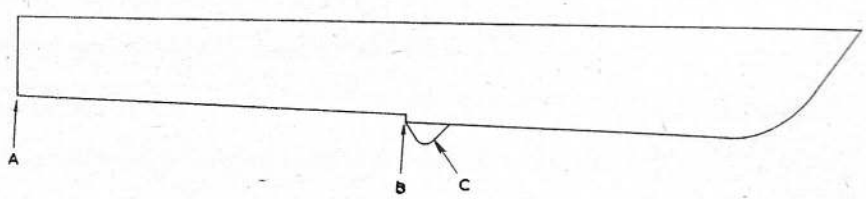
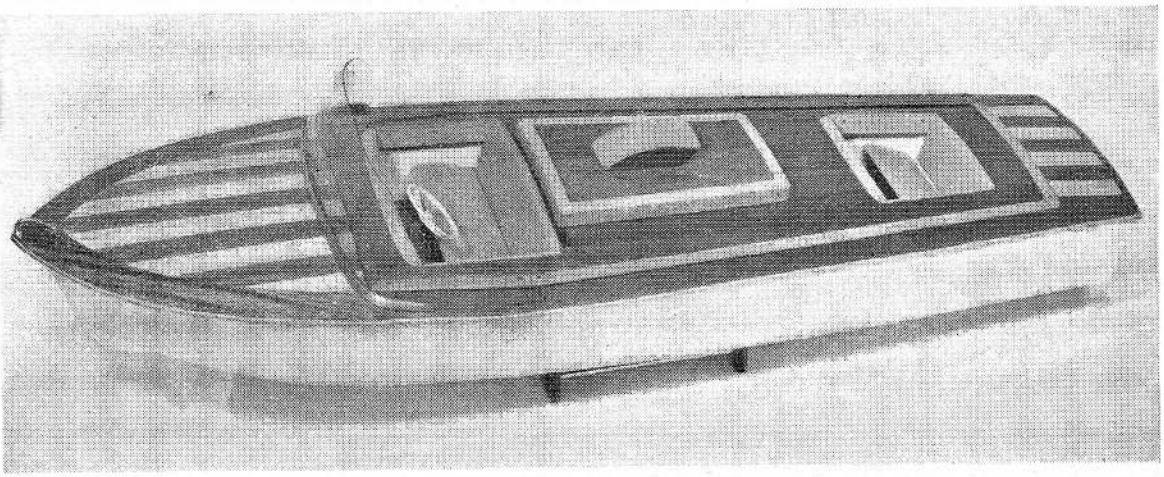


Fig. 5: *Stepped form. Keel plate* C; *pivoting point* B



Fibreglass hull built by Max Coote, with finish by Graham Caird

too deeply in the water at the stern.

I have mentioned the all-important question of hull resistance and have described one method of reducing it by making the hull plane. But the resistance can be lowered still further by reducing the "wetted area." It is done by the fitting of a step. (Here Mr Westbury's explanations are helpful.)

Fig. 5 shows a typical V-bottom hull, with step, which should be fitted approximately amidships and need only be quite shallow, on a 48 in. hull approximately $\frac{3}{8}$ in. deep, and following the contour of the hull as a flying boat is stepped. It will be seen that the hull is in contact with the water at points *A-B* only when it is planing. You will appreciate that at low speeds the step will cause increased resistance. But as we are interested only in high speed, we shall have to disregard pre-planing performance.

It is probably true that a stepped hull is very sensitive to variations in power, weight distribution, and trim; these factors tend to make the hull inconsistent in performance. If, for example, you do a run with a full tank, it does not follow that the performance will be better with only half a tank full.

You may think that because the boat is lighter it should go faster. This is not necessarily so. The alteration in trim by reducing the weight may quite likely upset things to such an extent that the bows drop lower in the water and, therefore, increase the wetted area disproportionately to the amount of weight removed.

Steering qualities

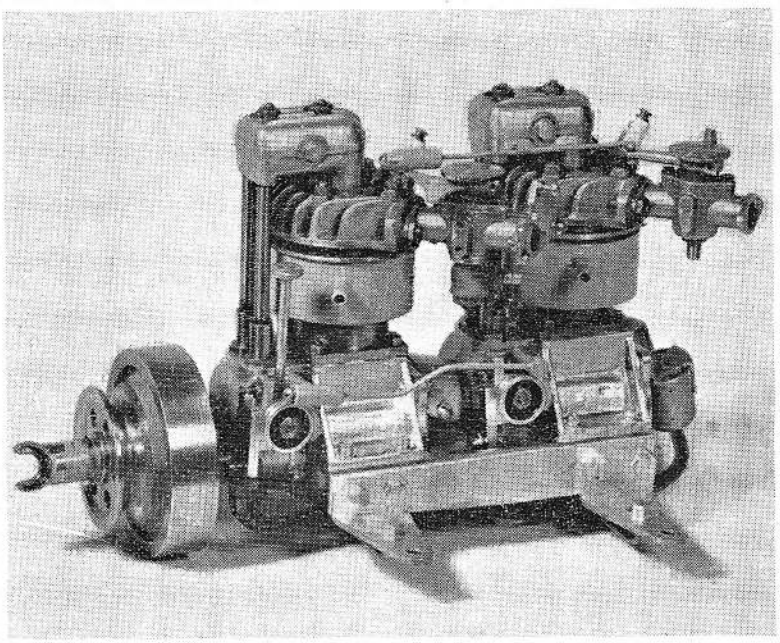
On a very light stepped hull directional stability may be lacking. The lack may be offset by the fitting of a small triangular fin to the keel, well forward, but still in the wetted area, as in Fig. 5.

To appreciate fully the effect of the fin on steering, it is necessary to understand how a boat turns. The rudder, when it is moved one way or the other, will have the effect of first moving the stern to one side momentarily, causing the keel to assume an angle to the path along which the boat is travelling. Consequently, the water in front of the boat, as it reaches the hull, will be presented with a surface greater than the usual symmetrical frontal shape and different from it.

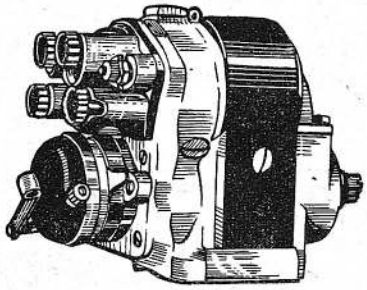
It is the pressure of the water on the hull, which largely decides the quality of turning. To turn a boat rapidly, the area presented to the oncoming water must be larger in front of the pivoting point than behind it. Hence our triangular fin.

A hull with the qualities which I have described will make possible a rudder area considerably less than is normally used.

★ *To be continued on March 16*



A. Washington of the South London Club built this 20 c.c. engine



MYSTERIES OF THE MAGNETO

By EDGAR T. WESTBURY

To many readers of ME, not to mention many thousands of engineers and laymen who claim to have a working knowledge of internal combustion engines, the magneto is a box of mystery. I have encountered a good deal of vague and fallacious reasoning in the course of dealing with numerous queries on the subject.

As magnetos embody both mechanical and electrical principles, though departing in both from established conventions, they may be said to form a kind of no-man's-land between the two. Nowhere, so far as I am aware, can any reliable information be found on their design, such as exists in profusion for most fields of mechanical or electrical engineering.

I have found that most mechanical engineers are scared to death of tackling magneto design, while those familiar with electrical or electronic work often dismiss the subject as trivial, and think it much easier to understand than it really is. For while magnetos share with all dynamos, motors and transformers the basic principles of electro-magnetic induction, the precise application of these principles is specialised, and needs to be carefully studied for a full understanding of the subject.

The magneto-electric generator, to give it its true generic title, is one of the oldest devices for mechanical generation of electricity (apart from frictional or influence static machines), and may even have pre-dated the type of machine defined as a dynamo-electric generator, generally used for producing electricity on a large scale. These terms are not truly descriptive, as both types of machine make use of magnetism in much the same way, except that the magneto-electric generator employs a permanent magnet, as distinct from the electro-magnet, energised by a field winding, in the other.

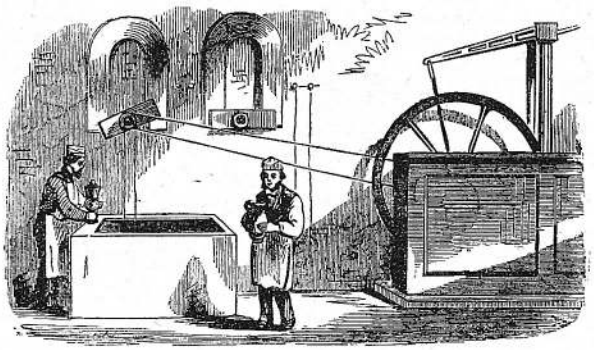
The earliest record of a magneto-electric generator is the one produced by Pixii in 1832, in which a permanent magnet and an electro-magnet, both of the traditional U-shape or horse-shoe type, have their poles in close juxtaposition. One part was made capable of rotational movement on an axis between the limbs of the U, so that the induced magnetism in the coils of the electro-magnet was reversed at each revolution. I do not propose to discuss the basic theory of induction, which is fully dealt with in any elementary text book on electricity and magnetism. Readers will all be sufficiently conversant with the subject to know that this motion will produce an alternating current in the coil windings.

It would seem from the information which I have on Pixii's machine, that the permanent magnet was the rotating member. Many years ago, I built a working model to demonstrate the principle of Pixii's machine, for use in a school laboratory, but this model, illustrated in Fig. 1, does not purport to be a true copy of the actual machine. Later machines generally employed a stationary magnet and rotating coils. One reason for this was that the magnets were weak and inefficient, being usually made of carbon steel, and had to be very large to ensure a sufficient concentration of magnetic flux. A hand-driven machine of this kind, manufactured by E. M. Clarke in the middle of last century, is seen in Fig. 2; it was intended for producing electric shocks, either for medical purposes or "for amusement only." The magnet was mounted vertically, and a spindle midway between the poles, with a soft iron crosspiece carrying two bobbins wound with fine wire mounted on it, was arranged to rotate as close to it as possible. Machines of generally similar type were popular up to well after 1900, and I acquired two of them for experimental purposes from one of those wonderful scientific curiosity shops which are now, alas almost entirely extinct.

Another and probaby more important reason for using rotating coils was that the machines were often required to produce direct (or, strictly speaking, unidirectional) current output, and this form of design was suited to the fitting of a commutator, to rectify the alternating pulses generated in the coils. The cumbersome bobbins were later replaced by the shuttle armature designed by Siemens. Still further improvements were the multiple armatures by Gramme and others, though they were more often employed in dynamo-electric machines. Permanent-magnet generators of quite large size, with several banks of magnets, were made in the latter part of the 19th century, and were used in lighthouse illumination, electro-plating and other practical applications (see Fig. 3). But the field intensity obtainable with them was much less than that of wound-field generators, and in later years their application has been confined mainly to quite small-scale armature output.

One of the most familiar examples of a small straightforward design of magneto is the one used in telephone systems for ringing a specially designed bell. A somewhat similar machine was developed for supplying current to bicycle lamps, but in recent years the rotary armature type has been superseded by the rotary-magnet type. No commutator is fitted, and the current produced is alternating; this applies to most small permanent-magnet magnetos. Several manufacturers have brought out model generators with permanent magnets; a typical example is the rotary magnet machine by Stuart Turner.

So far, I have confined myself to machines which give a more or less steady current output, generally at a relatively low voltage. They are usually less efficient, size for size, than wound-field generators, except for the modern alternators which are gradually coming into use on motor vehicles and, in conjunctiion with efficient metal rectifiers, may eventu-



Above, Fig. 3: *Early electro-plating shop with permanent magnet generators driven by a beam engine. Left, Fig.* 1: *Demonstration model of Pixii's magneto-electro machine*

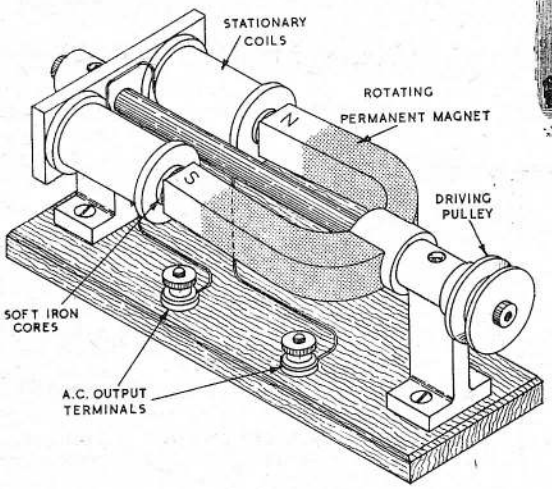


Fig. 2: *Clarke's machine of about* 1850

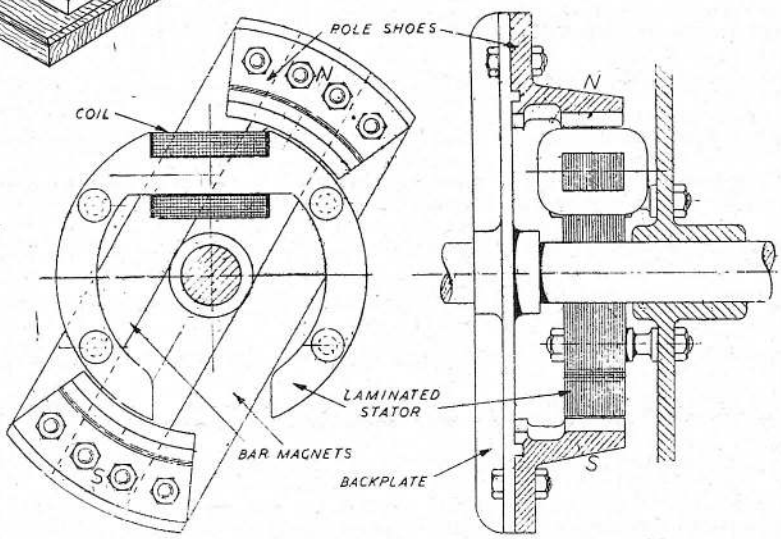
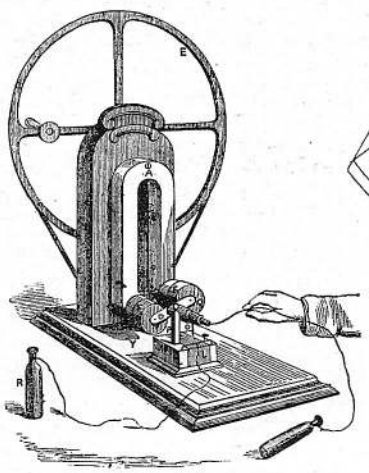


Fig. 4: *Albion low-tension rotary-magnet magneto*



ally supersede the present conventional type of automobile dynamo. Even for direct supply of d.c. current, the use of modern high-efficiency magnet steels enables them to compete with wound-field machines. But their output characteristics are not the same and they are less readily adapted for either automatic or manual control of output.

The magneto generator, however, has a property which is useful for some purposes; it can be designed to become inductively saturated at a limited speed, so that speeds over and above this give little or no rise in voltage. This principle is applied in the Dynohub cycle generator, which is of the multipole rotary-magnet type, with a high-impedance coil producing full output at walking pace. Permanent-magnet machines are also very accommodating in adjusting their voltage to the resistance to the working circuit. In this they are similar to dry batteries or other primary types, except that their output

does not become gradually lower on discharge, unless they are so overloaded as to become heated or cause leakage of insulation in the windings.

The magneto in which readers are most interested is the one used for spark ignition in internal combustion, and usually, though not invariably, designed to produce the momentary high-tension discharge without the help of any extraneous equipment. I may add that the high-tension magneto averted the infant mortality of the motor vehicle in the early days, as it ensured almost 100 per cent efficiency of the ignition system, previously one of the weakest links in the mechanism. The early battery and coil systems worked well enough when all things were kept up to concert pitch, but their essential components were often inadequate for their gruelling duties on the road. Coils designed on the principle of the Ruhmkorff coil, seen mostly in the experimental laboratory or the optician's shop window, though they were made by highly skilled instrument makers, often failed through damp getting into the insulation. They were rattled to pieces by vibration, and batteries often broke down through inadequate servicing or poor manufacture.

The first magnetos used for ignition were low-tension ones, many of them basically similar to the rotary armature machines. Sometimes they were run at speeds considerably higher than that of the engine, by gearing or belt drive, in order to produce a sufficiently high output, but this usually resulted in trouble, through poor design and inadequate lubrication of bearings. More robust machines, direct-driven at engine or camshaft speed, were more successful. Two well known examples were those on the early Albion and Lanchester cars. Both were of the rotary magnet type. As they were built into the engine flywheel, they were able to employ magnets of adequate size, and the windings could be well housed and protected, with no commutator brushes or other rubbing contacts (Figs. 4 and 5).

The current from low-tension magnetos could be applied to ignition in two different ways; either by feeding it to an induction coil to create a high-tension spark at a plug gap as in orthodox modern practice, or by producing an inductive spark (often incorrectly termed an arc) at electrodes inside the cylinder head, which were separated by mechanical or electromagnetic means at the moment that the spark was needed. Glow-plugs, with a filament or heater resistance maintained at incandescence by the magneto current, were tried out as

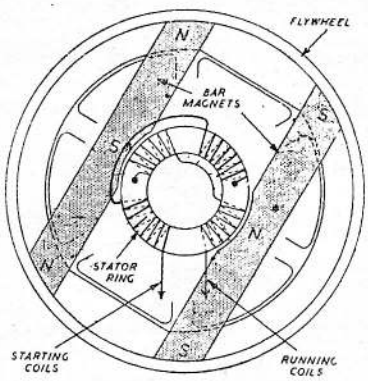


Fig. 5: Lanchester flywheel magneto

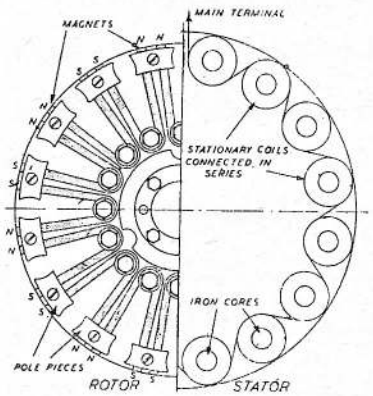


Fig. 6: Rotor magnets and stator coils in the Ford flywheel magneto

an alternative to the blowlamp-heated platinum tube favoured by some early car designers. They do not appear to have achieved practical success; more recently, they have reappeared to assist in the starting from cold of large diesel engines and miniature models.

Henry Ford, in his Model T car which appeared in 1908, and held its own for 20 years, used a multipole low-tension magneto. It was almost a reincarnation of a very early form of generator, having a large number (16 in all) of horseshoe magnets bolted to the face of the flywheel, with pole shoes attached to produce alternate N and S poles. A similar number of coils was mounted in the flywheel casing and connected in series to produce alternating current, which was fed in turn under the control of a distributor, to four separate trembler coils, whose h.t. output was fed to the appropriate plugs (Fig. 6). It was using a very large hammer to crack a very small nut. But though the output of both the generator and the coils was far more than adequate, it was by no means trouble-free; the most that could be said was that it generally managed to keep the engine running in some fashion.

In describing the Ford magneto I have digressed somewhat in time; this was desirable to keep the machines together in a particular class. The Albion and Lanchester magnetos may be regarded as the direct progenitors of the modern h.t. flywheel magneto, but this does not apply so accurately to the Ford type.

Magneto ignition may be said to have been properly established by the introduction of the self-contained high-tension magneto, which was developed almost simultaneously by several experimenters, though its invention is generally credited to Robert Bosch, who was certainly most successful in early attempts to produce a practical machine of this type. Some manufactures never completely overcame the teething troubles, including insulation of highly-stressed windings in very small space. The Bosch magneto revolutionised ignition from the beginning, and coil ignition was soon entirely superseded on motor vehicles; apart from its complete reliability, it had many other practical advantages, including the ease of fitting it and timing the spark, and the absence of a maze of leads and external connections, any one of which might be liable to faults that were difficult to trace. The only leads on the h.t. magneto were the plug lead (or leads, on multi-cylinder engines) and an earthing switch in the l.t. circuit, though the switch was often unnecessary.

My interest in magnetos dates from very early in my career, when the firm with which I was employed undertook the manufacture of a h.t. magneto, and quite naturally ran into quite a few difficulties which called for patient and searching investigation. Nobody then believed that anyone but the great R.B. could ever produce a satisfactory magneto, and as a result our product had to be proved very good indeed before there was any market for it. I became fascinated by the problems involved in magneto design, and I soon began to make my own experiments. Before the popular types of flywheel magneto were introduced, I made one which worked very successfully, though nobody could see any use for it at the time. This lightweight magneto was adapted at a later date for my Atom I model two-stroke engine. ▣

COUNTERSINKING and DEPTH DRILLING

WORKSHOP HINTS and TIPS

By GEOMETER

FOR functional purposes, countersinking of small numbers of holes can be done by judgment, checking frequently with a pattern screw or rivet. It is, however, a process on which uniformity is by no means easily obtained, and once an error has been made—a countersink produced too deep—there is nothing one can do about it. Unfortunately, too, such an error is rather obvious to a scrutinising eye.

When a countersink is too deep, there is an increase in diameter round the head of the screw or rivet—which a non-technical person can see after it has been pointed out. On the other hand, a countersink which is too shallow leaves the head of the screw or rivet upstanding, to catch anything such as a cloth rubbed over the surface. Of course, one may "correct" this effect by filing the screw or rivet flush. But by so doing, the head is made visibly small; and if there are several screws in an assembly, and they are ever removed, they must all go back to their original holes.

For easy assembling, then, as well as for good appearance, the heads of countersunk screws or rivets should be just flush with the surface in which they fit, *A*1; and for important work, sorting is advisable to eliminate any that are non-standard. It can be done with a piece of plate that has been carefully countersunk as a gauge.

For cheesehead screws sunk in the surface, *A*2, the fitting is again fairly critical. Usually the heads should not stand proud; but if the holes are noticeably sunken, the edges can collect a chamfer of dirt—which normal wiping will not remove. Still, a little sinking in this instance is generally acceptable. Greater tolerance is possible for flat-bottomed counterbores to take hexagon nuts or screws with hexagon heads, *A*3. Even here, it is desirable to have near-flush fitting of nuts or screws and uniformity in depths of holes.

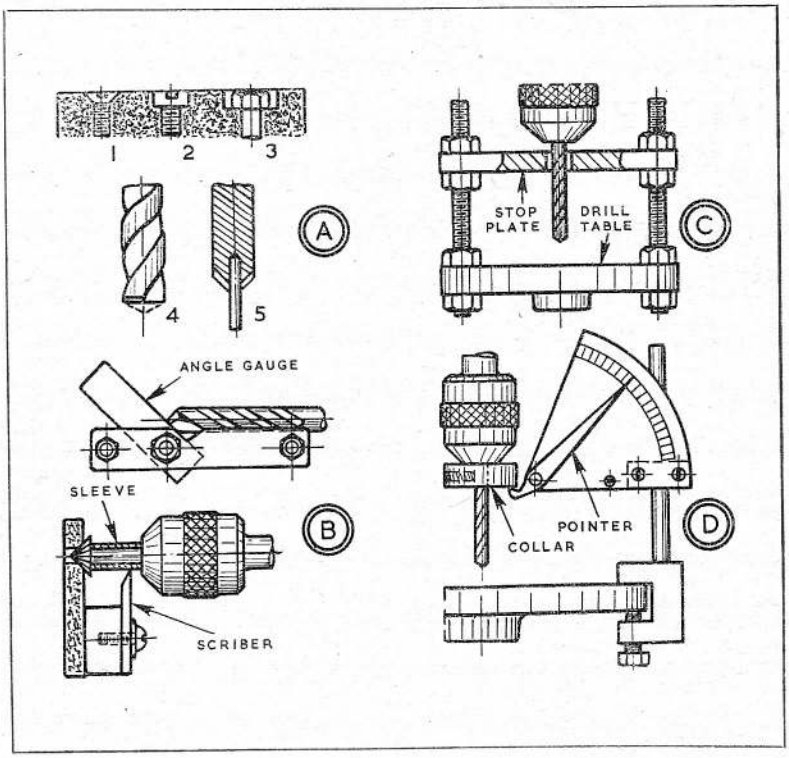
Usually, countersunk wood and metal screws, and rivets, have heads with included angles of 90 deg., which means that one must use a rose bit—particularly for wood or soft material—or grind a twist drill to angle, or make a tool in silver steel. This is essential for screws with a small parallel diameter at the top to which the countersinking tool should just give diametral clearance. The ordinary centre drill has an angle of 60 deg. A twist drill has an angle of 118 which agrees fairly well with rivets of 120, as does the centre drill exactly with those of 60, and so at times these drills can be used.

For a flat-bottomed hole, *A*2, a twist drill can be modified, *A*4, to follow in the hole enlarged by a twist drill of normal angle. A shallow flat-bottomed hole, *A*3 needs a pin-drill or flat-ended cutter in silver steel with integral pilot; while a countersinking tool, *A*5, which must have a pilot, is best made with it separate to facilitate filing the teeth.

A simple gauge to check the angle of lips on a twist drill, as they are ground, can be made from three pieces of flat strip metal, *B*. Two are bolted together at the ends with spacers, and the third is hinged between them. The drill lies in the two as in V-blocks. Setting of the gauge is done with a protractor, or from pencil or ink lines on paper, both for normal drilling angles of 118 deg. and countersinking angles of 90 deg.

In countersinking by hand drill, a flat scriber, *B*, on a small block, helps to control depth; it is held by one hand while the drill is used with the other. Either the shank of the drill, or a sleeve on it, has a line for reference, which is easily seen against a coating of marking blue.

On a drilling machine, depth control of countersinks or flat-bottomed holes is maintained by a suitable stop, *C*, or a gauge with a sensitive pointer, *D*. Sometimes, the pointer can be applied to the sliding sleeve or quill of the machine. When this is not possible, a collar grub-screwed to the drill is used. ▣



Continued from 26 February 1961, pages 191, 192 and 193

Here is the easiest way to fit those tricky cross-tubes

says J. J. CONSTABLE in his third instalment on the 5 in. gauge Sentinel which gained a premier award at the Model Engineer Exhibition in 1958

THIS week we come to the only tricky part in building the boiler. Careful marking out of the firebox and the drilling for the cross-tubes is essential. In considering the best way to describe this process, I decided that of several methods the easiest might be the one illustrated in Fig. 8, which shows the 12 cross-tubes and the centres for drilling.

I found that the external circumference of the firebox was almost 24 centimetres, and thus a convenient length for dividing up into the 24 equal parts, each of which would give one of the centre lines. The cross lines were then marked out as shown, and their intersection gave the centre points. For ease of marking a piece of paper was drawn out carefully, stuck round the firebox, and centre marked for drilling in the lathe.

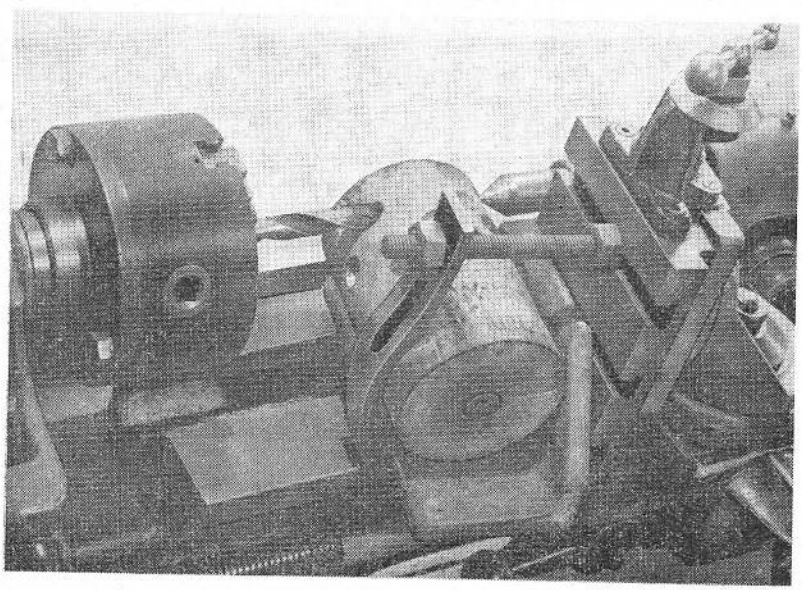
You will see set up in Photograph 8 which, although it shows only the wood former, is nevertheless the method which I used. The firebox with the wood former inserted was mounted on an angle plate which in turn was mounted on the vertical slide. I lightly clamped the firebox on to the angle plate with a strap of $\frac{1}{8}$ in. or $\frac{3}{16}$ in. × 1 in. mild steel strip, after making sure that the angle plate was horizontal. The vertical slide was then set for angle and height to line up the lathe centres with the centre pops already marked on the firebox. A centre drill was held in the chuck and the back centre was brought up to the firebox; and the vertical slide and firebox were adjusted until the two pop marks, indicating the centres of the cross-tube to be drilled for, lined up exactly with the centre drill and the lathe back centre.

All was now tightened down and drilling began. I found the best way to enter the point of a centre-drill (Slocombe), with the tailstock as a pusher, until the centre drill just cut through the copper. The centre drill was then changed for a $\frac{7}{16}$ in. end mill, and the operation was continued until all the copper had been cut away. The end mill was then changed for a $\frac{7}{16}$ in. All the advancing of the work towards the drill was done mainly with the lathe tailstock and the saddle only, assisted with the hand-wheel. I occasionally withdrew the work from the drill to clear the wood shavings and I was not too greedy with the feed.

As soon as the drill had penetrated nearly to the copper at the back end, I withdrew the lathe centre and carefully continued to feed the saddle towards the drill with the saddle hand-wheel. The drill did not wander as it cut the copper for it had plenty of support from the hard wood former. As could be seen from an illustration to my last article, the spaces between the holes came out fairly even.

Once the vertical slide has been set for angle and height it will not have to be disturbed for drilling the other holes. All that is needed is to release the clamp holding the firebox to the angle plate, turn the firebox round to the next hole, and repeat the process. I found that, once the first hole had been drilled, the time taken to drill the others was very little.

Do not run the lathe too fast; in using the end mill, low speed is the best; and in cutting the hole in the copper, use some suds. When we have drilled all the 12 holes, the former can be removed from the firebox and we can fit the cross tubes. I found that the best way to do this with the least waste of material was to insert one end of the 3 ft length of $\frac{7}{16}$ in. o.d. tube until it just poked through the other side and, with a junior hacksaw, cut it off at the same angle with the firebox, leaving about $\frac{1}{16}$ in. proud. The angle left on the main piece came in for the next tube; there are thrifty ancestors somewhere in the family tree.



Photograph 8: *Drilling set-up for the cross-tubes*

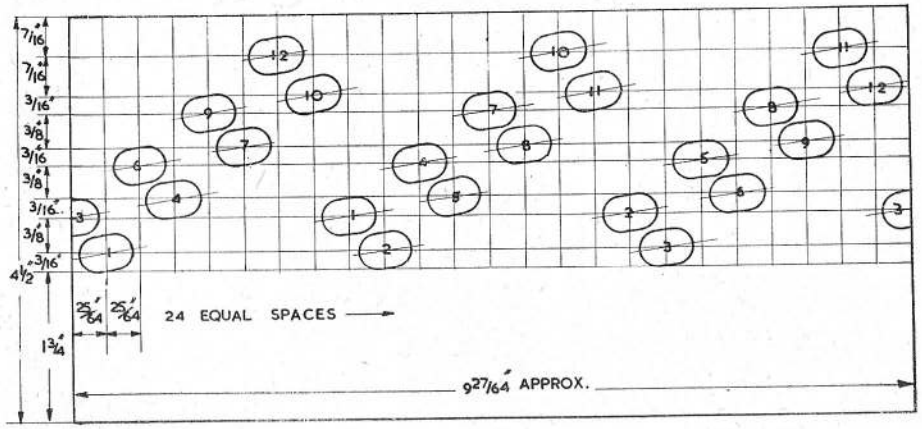


FIG 8

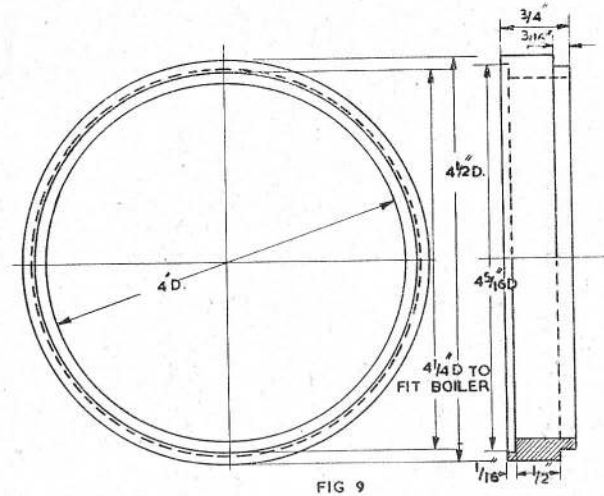


FIG 9

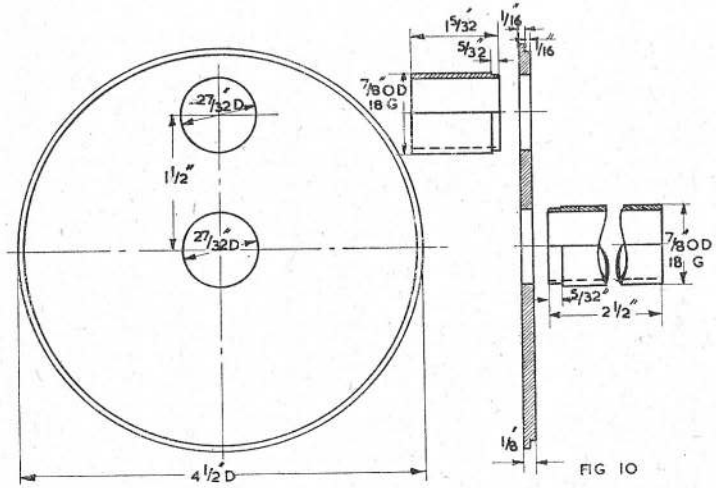
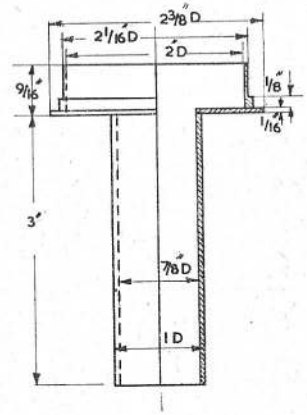


FIG 10



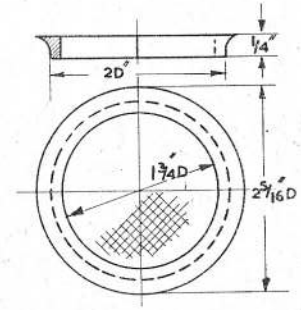


FIG 11

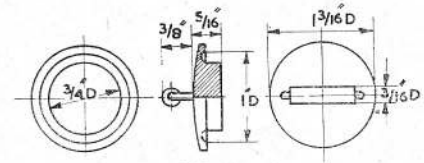


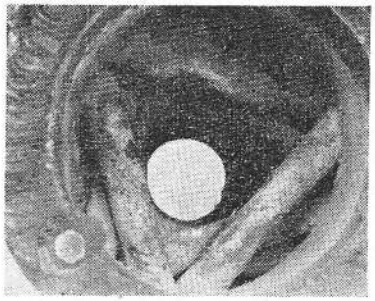
FIG 12

Repeat this process until all the tubes have been fitted, making sure that they are quite clean where they come through each side of the firebox. If needed, slightly rub with a bit of emery cloth.

I did not find it necessary to ream the holes and all the tubes were a nice fit for the silver-soldering. There is no reason why the whole of the boiler cannot be silver-soldered with Easy-flo or a combination of Easy-flo and a coarser grade, such as B6. For those who would like to Sifbronze some of the joints, such as the foundation ring and the flue tube, a good way to ensure that the melted brass runs well into the joints is to use a little silver-soldering first and continue heating up until the brass runs freely, when it will follow the silver solder right through.

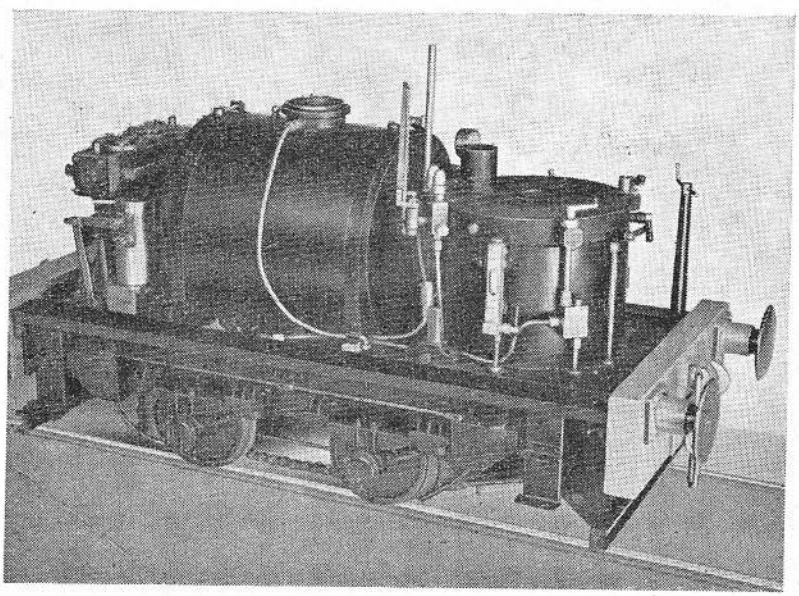
In silver-soldering or brazing, the work must be hot enough to make sure that whatever is used runs freely and really penetrates the joints. The heating can be overdone. Those who can use oxy-acetylene equipment know the ease with which a hole can be made in copper boilers.

Make sure that the joints are clean and covered with the proper flux. It is sometimes advantageous to flux both the parts to be put together, but generally when the job is heated the flux will run through the joints and be followed by the silver solder. To braze the flue tube into the crown, flux both pieces, put into position, and stand the crown on a piece of firebrick with the flue tube uppermost. Heat up to bright red and apply the silver-solder. If the heat is sufficient the solder will flash right round the joint with very little trouble and leave a good fillet both sides.



Photograph 9: *Cross holes in firebox*

Most of my jobs of this size are done with $\frac{1}{16}$ in. dia. silver-solder wire. It is a convenient size, and the least wasteful of material. Make sure that the joint has been satisfactorily soldered, allow it to cool to black, and then quench in cold water or pickle—a dilute solution of sulphuric acid (specific gravity about 1.20) which the chemist will make up. I usually prefer water; it is less liable to damage my clothing if I get splashed; all I do to wash off any surplus flux is to scrub the joint thoroughly in hot water. If the surplus flux is not removed the work will look messy, and when the boiler is assembled it will probably prime like fun, and you will swear that someone put a piece of soap in while your back was turned.



Photograph 10: *Nearside of* SIRENA *without tin-work*

The next bit is to silver-solder the firebox crown to firebox and tubes. Place the crown, with the flue tube already brazed into place, on a piece of firebrick with the flanged part uppermost. Flux all round, and then place the firebox into position with all the tubes also well fluxed. Heat up the crown to a bright red and silver solder this part first. At the same heat go all round the tubes with the best Easy-flo and braze them into place.

Photograph No 9 is a close-up of the tubes in the completed boiler. Do not rush the work, and make sure that all the tubes are properly soldered. A good fillet should be visible on the outside as well as the inside. Allow to cool to black, quench in pickle or water, and scrub in hot water afterwards.

As it will be almost impossible to repair any leaks in the tube once the firebox is put into position in the boiler, you must thoroughly test the firebox before any further work is done on the boiler. Turn up a piece of hard wood about 1 in. thick to about $3\frac{1}{2}$ in. dia. and be sure that one side is well faced off. While it is in the chuck, drill a $\frac{3}{8}$ in. hole through the centre. Turn up a similar piece of hard wood, this time about $2\frac{1}{2}$ in. dia., and again drill a $\frac{3}{8}$ in. centre hole.

A piece of $\frac{3}{8}$ in. dia. rod about 9 in. long should now be threaded $\frac{3}{8}$ in. BSF, or another convenient thread, for $\frac{1}{2}$ in. at one end. The other end should be turned down to $\frac{1}{4}$ in. dia. for $\frac{1}{2}$ in. and threaded $\frac{1}{4}$ in. $\times$ 40 for about $\frac{1}{4}$ in. While in the chuck, the end should be centred and a 3/32 in. hole drilled to a depth of $1\frac{1}{2}$ in.

The rod is slightly pulled out from the chuck and threaded for $\frac{3}{4}$ in. with a $\frac{3}{8}$ in. BSF, or a similar thread to the one on the other end. It is removed from the chuck and, at $1\frac{1}{2}$ in. from the end, is cross-drilled with a $\frac{1}{16}$ in. drill so that the cross hole breaks into the 3/32 in. hole drilled earlier; it is then ready to hold the two hard wood discs for testing the firebox. The set-up is shown in Fig. 7.

A piece of rubber (inner tube from a car will do) is put between each disc of hard wood and either the firebox or the flue tube to act as a water seal in testing. The connection to the water pump and the pressure gauge is made via the $\frac{1}{4}$ in $\times$ 40 thread at the end of the rod.

As the working pressure of the boiler is 100 lb., the firebox should be subjected to a hydraulic test of 200 lb. If any leaks show up, the spot should be marked; more flux is applied and the silver-soldering process is repeated.

I strongly advise that no attempt be made to put right any leaks, or

● *Continued on page 275*

STEAM on the MOUNTAIN

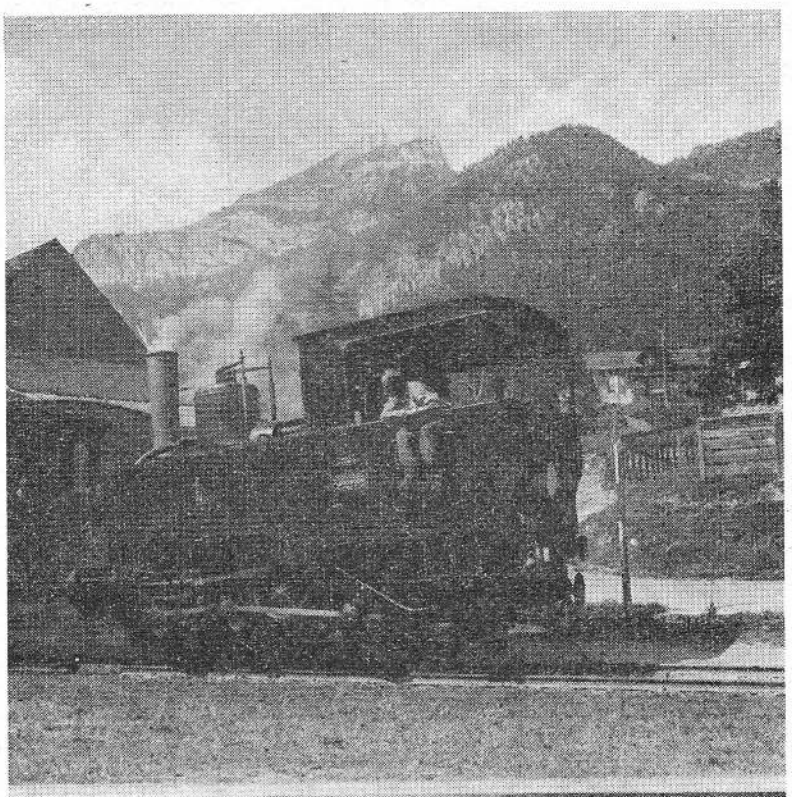
PETER SCOTT, a London advertising manager, takes a trip up the noble Aachensee

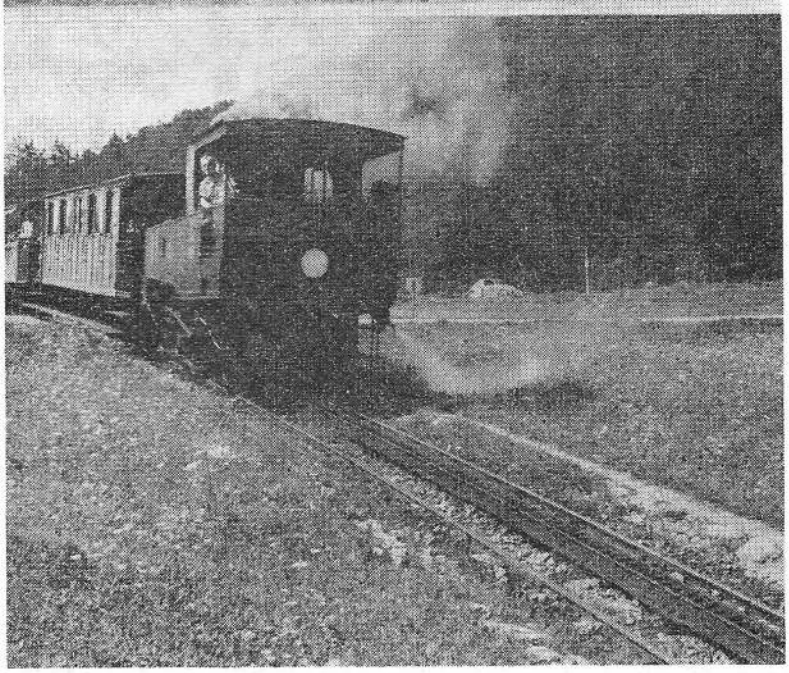
THESE photographs illustrate one of the two remaining steam-driven rack railways in Continental Europe—the eight-mile line from Jenback in the Inn Valley up to Pertisau on the Aachensee, 4,000 ft high.

Here is locomotive No 784 built by the Vienna Locomotive Works nine years after the line was opened. She has been on the job for 72 years. The twin outside cylinders drive a centrally-placed crankshaft, with light flywheels on each side carrying band brakes on their periphery. The gear reduction to the jackshaft is about $2\frac{1}{2}$: 1, and the jackshaft drives the track wheels by articulated connecting rods; the central toothed driving wheel can be seen below the flywheel.

The railway uses the Riggenbach rack system, which is generally employed where severe gradients and sharp bends occur together. No 784, although mechanically very noisy, seems to have plenty of punch from the way that it propels two 40-seater coaches up to Aachensee.

Europe's other steam rack railway is the Brienzer Rothorn. The Brienzer and the Snowdon in Wales were built within a year of each other. Their locomotives came from Winterthur in Switzerland. ▣





MODEL ENGINEER INDEX

The index for Volume 123, July-December 1960, is now to hand from the printer and may be obtained from the Sales Department, Percival Marshall Ltd, 19-20 Noel Street, London W1, price 1s.

FOUR HOURS FROM DANTE

While others raked the white hot coke, the new apprentice toiled away in the furnace-glow and clouds of golden, gas-lit steam. GEORGE W. EVES continues his 'Black Sand'

COREMAKING was suspended. The coreboxes were cleaned and put up on the shelves. Sand went into a handy iron tank. Tools were put away. From the oven we brought out trays of hot dry cores. I was shown how to clear the vent holes, how to rub a small taper on the end, so as not to crush the core prints when the top box was put on; how to sand-paper off the joint marks. . . .

Fine powdered graphite was stirred into water to produce a thin smooth paste. Each core was then carefully coated. With too much, the graphite powders when molten metal touches it, and there is a hole in the finished casting. With not enough, the metal burns the sand to it—ruinous to lathe and planer tools. If the work is done slowly, the core soaks up all the water in the brush and the whole disintegrates in your fingers. And if it is done too quickly. . . .

All day we fetched and returned to the oven. I mixed gallons of graphited brew, and managed to get quite a bit over myself, as well as on the cores. When I wearily slid the oven doors shut that night, the fire burned bright and I noted a new drawing on the door—myself, in oversize cap and overalls, with the caption: "Charlie's Aunt."

Solemn occasion

My job next day was to take the cores to the moulders. To and from the oven I trailed, bearing plates of cores as one would the Royal Sceptre. I would pause to watch a moulder blow down the vent to make sure it was free, before it was deftly inserted in the core prints, and the escape vent scratched out with the sharp end of the art trowel. At noon he cores were all in. I watched the moulds being weighted down with half hundredweights.

I was shown how to mix up clay for the wads. These hold the molten metal back in the furnace until there is enough to fill the cauldron. To a lump of glutinous yellow clay on the beating board are added sawdust, very fine coal dust and a little yellow sand. With a blunt bar, the stuff is chopped again and again, until the ingredients are thoroughly mixed. The coal dust and the sawdust must be inside the clay and a handful must bind readily. I looked like a black man. My arms ached fit to drop off before the furnaceman declared the stuff just about passable; for whereas dry clay will barely hold together, wet clay is highly dangerous. My appearance called for mirth, and those around were quick to tell me that the place for coaldust was in the clay and not on my face. The dinner time bell was more than welcome.

When I returned, things were moving. The Ruston portable was driving a big countershaft on which a 10 ft dia. pulley wheel was connected to the blast fan with a 1 ft wide interlaced leather belt. To stand by the smokebox door and hear the exhaust beats was to admire the men who kept the engine in tip-top condition.

Mighty roar

I went outside to the furnace which trembled with the terrific blast of air going into it. On the charging platform, conversation was impossible because of the mighty roar. Showers of sparks flew skywards as into the maw of the furnace went shovelfuls of coke, and then chalk and cast iron scrap. Back inside the foundry, a huge tongue of flame leapt across the place from the tapping out hole, for all the world like an oversize blowlamp. As I watched, fascinated by it all, the flame grew less and less, until a thin trickle of molten metal cascaded to the floor. Casting was about to begin.

I still recall that afternoon; especially when I hear men talking about hard work, for if there is anything today like casting in the early part of this century, then I would like to know of it. From the moment when the first pot of metal was carried away from the furnace by three brawny labourers, my every moment was fully occupied. Charles joined the moulders weight shifting, which meant that for the rest of the afternoon he would be moving half-hundredweights often too hot to handle without a break from box to box as each one was filled. I became the tapper-out's assistant, and was shown how to make the clay into wads, to stop the flow.

A handful of the stuff was made into a cone, and with your finger you pushed a hole nearly through from the base. Into this coaldust was poured, and then the clay was pulled over it to prevent its loss. The wad stick, a 6 ft long iron rod with a 4 in steel disc riveted on top, was dipped in slurry, and the wad was planked on this quickly. Your left hand rotated the wadstick, and your right pulled the wad down hard. The result was a clay cone on top of the wadstick which would not fall off when it was held horizontal. Two extras were kept ready in case one dropped off, which needless to say happened before long. The agonised cry of: "Wad up, George!" could have been heard in the next parish.

Castings which needed no machining were poured first—firebars for engines undergoing repair, skidpans for farm carts, and wheels for ploughs, brakes and dibbers. Clouds of steam rose from them, and off came jackets and waistcoats.

Promotion

Having mastered the art of the wad-boy, I was promoted to relief skimmer, a doubtful promotion if ever there was one. The skimmer is a small paddle on the end of a 7 ft long rod. With it you take off the dross floating on top of the metal the moment the wad has been rammed home. The main thing is to remember to warm the skimmer first. A cold skimmer, the moment it touches the molten metal, will send showers of white hot globules flying in all directions. The particles of molten metal stick to the skin, penetrate clothing like a bullet, and are mighty painful.

When the pourers were in position and the lip of the pot poised over the pouring cup on the mould, I gave the usual shout of: "Right away!" Down went the metal, while I stood and roasted, keeping the dross from following.

Then came the turn of moulds whose ultimate castings had to be machined. There were pulleys, and cog wheels. Big pinions for brick-making machinery had to be fed. For this a riser, 3 in. or more in diameter, is provided on top. It fills

when the mould is poured, until the feeding cup which holds about half a gallon of metal is topped up. The feeding rod is a length of ⅜ in. soft iron rod.

The man who does this skilled job notes the position of the vertical riser, because when the cup is filled to the brim it can be anywhere below. The moment that the mould is filled, he goes into action. It is scorching hot work with no let up for half an hour.

Gently the feeding rod is lowered into the metal. Here the master touch comes in, for the rod must go half-way down the vertical riser. As solid chunks of metal cool, the metal shrinks and the highest point sinks downwards. Steady up-and-down action of the rod pumps metal down into the sagging area. If your touch is poor, the rod will scrape the side of the riser, which is only sand. Once started, feeding must not stop, or the metal sets. Rods load up with metal, and a spare must always be on hand. After half an hour of feeding, you can well dispense with your shirt.

The heat in the foundry was killing. With the billowing clouds of steam mingled the choking fumes given off by the sand burning next to the casting. The air was charged with fine penetrating dust which burned throat and nostrils. Everybody's face glistened with perspiration, which the elders assured me was good for one's general health. Tongues of flame lolled out from the open ends of the larger cores. Smaller ones spouted flames like gas jets, before the flames gave way to acrid smoke.

Although I was exhausted, there was always the cry of: "Wads up, George!" I began to wonder however they managed before I arrived. Yet, my lot was easy compared with the lot of the men who slaved away carrying the great pots of molten metal up and down those endless rows.

As night fell, the gas jets were lit up, but precious little light they gave where the glow from the pots outshone them. The glow illuminated the rising clouds of steam, turning them into golden vapours. Once I stole outside, where the light, leaping high above the furnace maw, lit up the entire yard, the foreman's garden beyond and the willows lining the river bank. The man on the charging gantry looked like something out of Dante's Inferno.

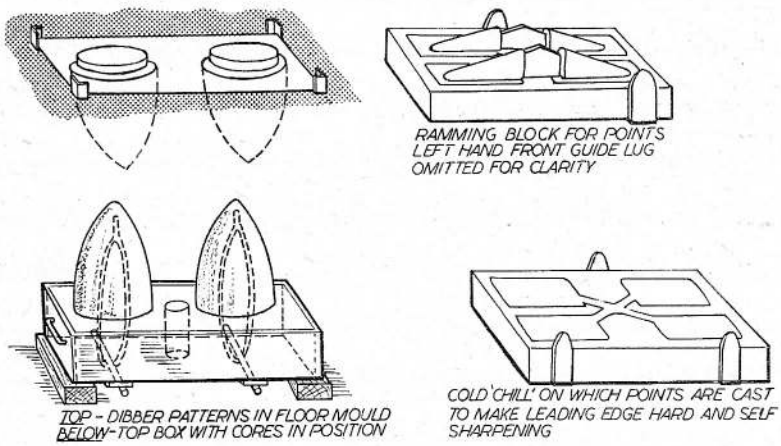
That first cast lasted four hours. It seemed more like weeks. I lived in a world made up of wads, skimming and feeding and I nearly wept for joy when the tapper out called: "Last pot, chaps" and—much more important—"No more wads."

But there still remained much hard work. The trestles on which the pots rested as they filled were whisked away, and a large steel sheet screen was set up. Men attacked the front of the furnace with long pointed crowbars. A wedge was knocked out, followed by a clamping which allowed a plate 2 ft square to topple to the floor, revealing the white interior of the furnace. To look at it for seconds changed your vision from white to violet.

Behind the screen, men with 20 ft bars raked out the white hot coke, and the dross and ganister displaced from the furnace lining, while a couple of us threw bucketsful of water, which was immediately changed to steam. The rakers were relieved at intervals of a minute, as it was impossible to face the heat any longer. I hurled one final bucket of water before I rejoined the rest of the sweating gang in the trimming shop, where they sank on to convenient seats.

Everybody was exhausted, and little was said. Pipes were lit up, strictly against rules. When someone said that it was a good cast, the tapper-out replied: "It would have bin if I'd had some decent wads." But the stern face slowly resolved itself into a grin, and I knew that I had "arrived."

★ *To be continued*


RAMMING BLOCK FOR POINTS LEFT HAND FRONT GUIDE LUG OMITTED FOR CLARITY
TOP - DIBBER PATTERNS IN FLOOR MOULD BELOW - TOP BOX WITH CORES IN POSITION
COLD 'CHILL' ON WHICH POINTS ARE CAST TO MAKE LEADING EDGE HARD AND SELF SHARPENING

Some of the moulds and blocks

A NOVEL TRANSMISSION SYSTEM

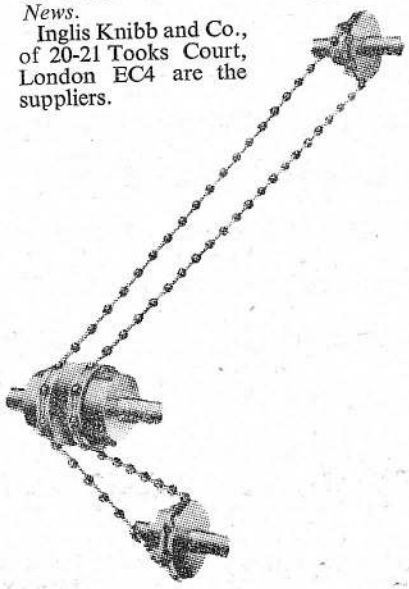
A NEW mechanical drive, as an alternative to a belt or gear wheel system, uses a string having balls moulded into it at regular intervals in conjunction with pulleys having corresponding sockets round their periphery. The strings are of practically stretch-proof plastic material and the balls are moulded into them during manufacture. The operation of the drive does not depend on pre-tensioning the string, and therefore does not impose additional pressure on the pulley bearings.

The system is very suitable for such purposes as the transmission of instrument readings to remote indicators, or of control movements to remote instruments, where accurate slip-free transfer is required.

For instrument purposes, sizes down to 1.5 mm. balls on a 0.5 mm. string are available, and these are sufficiently flexible to work round very small pulleys. Larger sizes, up to those suitable for power transmission, are also made.

The above information is based on an article in *Industrial Equipment News*.

Inglis Knibb and Co., of 20-21 Tooks Court, London EC4 are the suppliers.



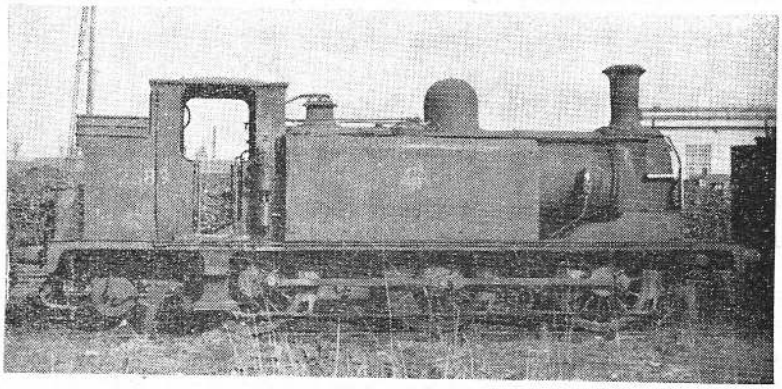
Continued from 16 February 1961, pages 208 and 209

LIBRARY OF LOCOMOTIVES

An ME Staff feature

By ROBIN ORCHARD

Pictures by Brian Western



No 32689, *once No* 89 BREST *on the LBSCR, was rebuilt in* 1911 *to become an E1/X class engine. It was scrapped in* 1960. *The picture was taken at Eastleigh, a few miles from Southampton*

THEIR NAMES WERE TAKEN AWAY—50 years ago

BASICALLY the E1 0-6-0Ts were D1 0-4-2Ts with a different wheel arrangement. Hence the dimensions are almost the same. The two cylinders, set on the inside, are of 17 in. bore × 24 in. stroke; the coupled wheels are of 4 ft 6 in. dia.; the total wheelbase of 15 ft 3 in. is made up of 7 ft 6 in. and 7 ft 9 in.; and the total length over buffers is 32 ft 4½ in.

With a length of 10 ft 2 in., the boiler slightly tapers from 4 ft dia. at the rear to 3 ft 10 in. at the front and is pitched 6 ft 11 in. above the rails. The firebox is 5 ft 2¼ in. long, and the heating surface was made up of 895 sq. ft (tubes) and 82 sq. ft (firebox), a total of 977 sq. ft. There is a grate area of 15.5 sq. ft.

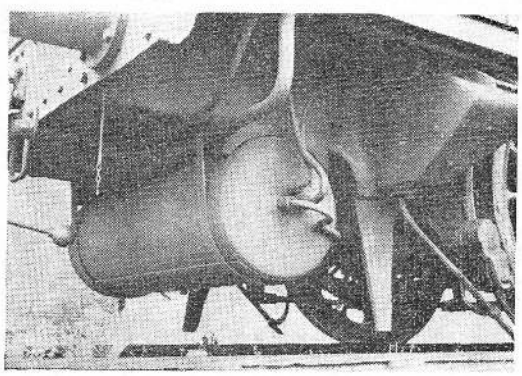
Water capacity is 900 gallons and coal capacity 1½ tons. The total weight is 44 tons 3 cwt, 12 tons 15 cwt on the leading axle, 15 tons 10 cwt on the centre axle, and 15 tons 18 cwt on the trailing axle. Maximum width is 8 ft 6 in.

The engines were constantly modified and given new boilers by Billinton and Marsh.

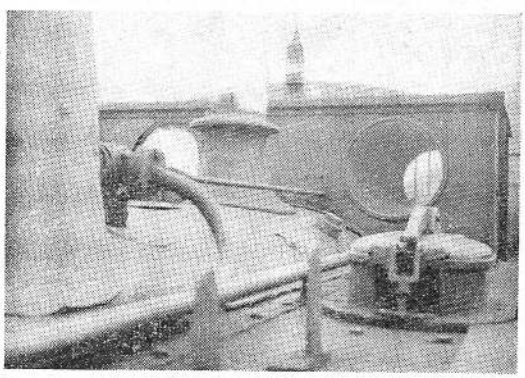
Originally the Stroudley engines bore the new livery of green edged with black with the names in shaded gold on the tank sides. Some of them had the smart Stroudley yellow or improved engine green, whichever way you like to think of it. They were 85-97, 101, 117-119, 123, 128, 129 and 145-156.

The last six locomotives built, Nos 159 to 164, were introduced after the death of Stroudley by his successor R. J. Billinton. While they were fundamentally the same as the Stroudley engines, they showed the mark of the new man in their Billinton boiler, cast iron chimney, cast iron leading splashers and sandboxes (fore and aft of the driving wheels) steam sanding, and cast steel wheels. Leading and trailing wheels had large balance weights, like the driving wheels on the earlier engines. The cab windows opened, there were ventilators in the roof, and combination injectors replaced the cross-head-worked pumps. Most of the other locomotives gradually fell into line with them.

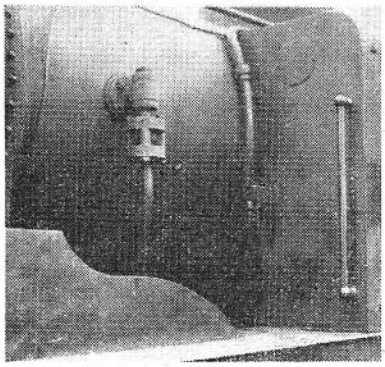
Stroudley's last E1 painted at first in the passenger engine livery was rather different from all the others. It was built specially for working over



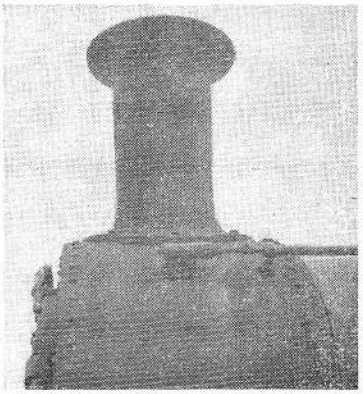
Air brake reservoir



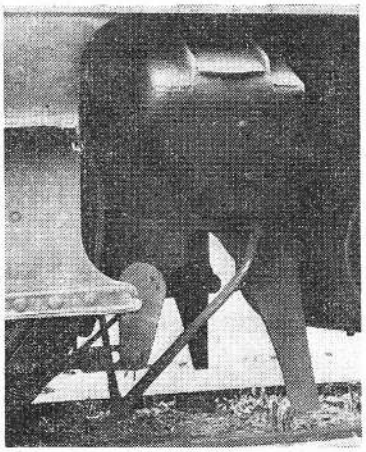
Marsh safety valves. At first the engine bore Salter valves on the dome. The whistle is worth noting



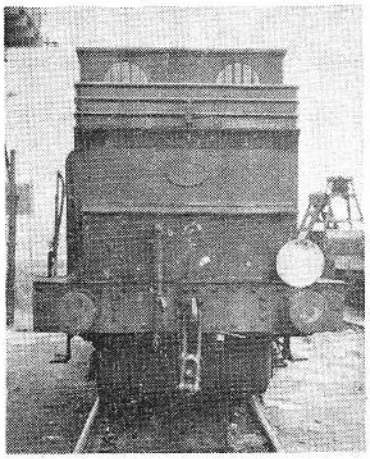
Here are the boiler clack and tank front. Note the oilbox and handrail



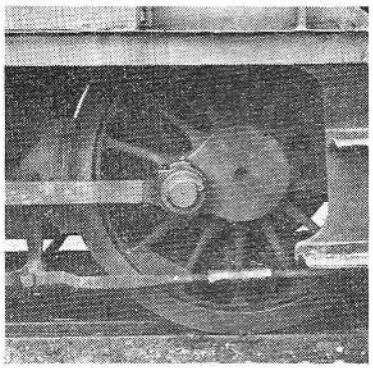
Once upon a time this engine carried a Stroudley chimney with a copper cap



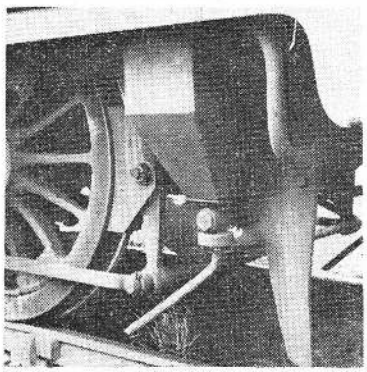
Cast iron sandbox



Note the coal rails and toolbox. The cast plate, with "W4", is one of the plates fitted in the Isle of Wight



Rear coupled wheel. The plate has been riveted on for correct balance of wheel



Modern sandbox made from plate and welded up, at the front of the engine

the severely graded line between Eastbourne and Tunbridge Wells. The 18½ × 26 in cylinders had the valves underneath. A larger set of tanks carried 1,052 gallons and the coal capacity was increased. A wheel and screw reverser took the place of the usual lever fitted to the class, and a duplex pump replaced the pumps worked by the crosshead. The boiler was pitched higher at 7 ft 2$\frac{3}{16}$ in.

In 1911 Douglas Earle-Marsh, who had succeeded Billinton at Brighton, decided to rebuild one of the E1 class tanks on the lines of a D1 tank which he had rebuilt earlier. He gave it a 4 ft 6 in. dia. Marsh boiler pressed to 170 p.s.i. and pitched 7 ft 9 in. above rail level. The heating surface was reduced and the weight increased. To improve visibility from the engine, the cab roof and footplate were raised. But the experiment was apparently not a great success, as no further locomotives were so rebuilt.

The engine which was officially classed E1/X, survived in this condition until the boiler was condemned in 1930. It was not scrapped, but was rebuilt to match the remainder of the class with parts cannibalised from similar engines which had been scrapped.

You will see the engines in some of the photographs illustrating this series; as B689, 2689 and 32689, it remained until 1960 and had the distinction of being one of the last in service.

As soon as Marsh had settled in, he changed the green livery for goods engines to black lined out with two fine red lines. The names vanished for ever, and the engines became known as "Black Tanks."

Scrapping of the E1s began as early as 1908. Altogether some 13 were cut up by the grouping in 1923. No 146 was sold, and 63 were inherited by the Southern. During the years of Southern Railway ownership the scrapping continued, but the scrapping was not extensive.

By the time of nationalisation, the number of E1 class 0-6-0Ts had dropped to 30, though it can be argued that the figure was 40 as ten were rebuilt. Of the remaining 23 engines withdrawn by the Southern from 1923-1948. 19 were scrapped and four were sold. No 110 went to the Rugeley Colliery in Staffordshire. It stands a good chance of being the last E1 in service as the life of 32694, the sole survivor on British Railways, must now be very short

★ *To be continued on March 16*

Continued from 16 February 1961, pages 205, 206 and 207

IT CAN HELP TO MAKE ITSELF

In the third instalment of the serial for young craftsmen, N. F. HALLOWS puts the tool to work making the guide fences

At first the toggle-bar should be cut off over-length. It is then carefully shortened until, when in position, it stands nearly upright and exerts enough pressure to hold the box securely in place. To prevent the escape of swarf, the gap between the two parts of the table at the front edge is filled with a short length of plastic strip.

Oak board 1 in. thick is used for the two parts of the baseboard assembly. The block for raising the saw pedestal is necessary to bring the surface of the table above the level of the motor, so as to accommodate large work.

If the pedestal is fixed with round-head wood screws in the position indicated in the drawing, the ¼ h.p. motor is lined up for marking out the centres of the holes for the holding-down bolts. With the two pulleys and the driving belt in place, align the faces of the pulleys with a straight edge and, at the same time, make allowance for any difference in the width of the pulleys. Place a short length of ¼ in. dia. rod, pointed at one end, in each of the slots in the motor feet and strike the punch a light blow with a hammer to mark the bolt centres. An allowance for belt tension adjustment must be made.

For the mains feed to the motor the male half of a three-pin flex connector is fixed to the under side of the baseboard, and its female counterpart is wired to the input. This leaves the machine free from cumbersome attached wiring and also provides for an earthing connection where this is considered necessary for added safety.

The machine is controlled by an Arcolectric 3-amp, sliding thumb switch, let into the baseboard. Wiring connections are run out of sight underneath the wooden base and held in place with small saddles. The wiring is straightforward: one lead goes direct from the connector to the motor, and the live lead is taken from the connector, through the switch, to the other motor terminal. For a neat appearance, enclose the two motor leads in plastic tubular sheathing.

Before being French-polished, the edges of both the wooden parts are chamfered and the surfaces are finished with fine glass-paper. Labour will be saved if the grain of the oak is first filled with a preparation such as Alabastine. In the polishing, Amatrix will give an excellent finish with very little work.

To provide even standing for the machine, and to enable it to be more easily lifted, four rubber buttons, of the kind fixed to lavatory seats, are fitted to the under side of the baseboard.

The standard pattern circular saws are 4 in. dia. with a ½ in. dia. bore; the carbon-steel saw for cutting wood is 1/32 in. thick and has its alternately

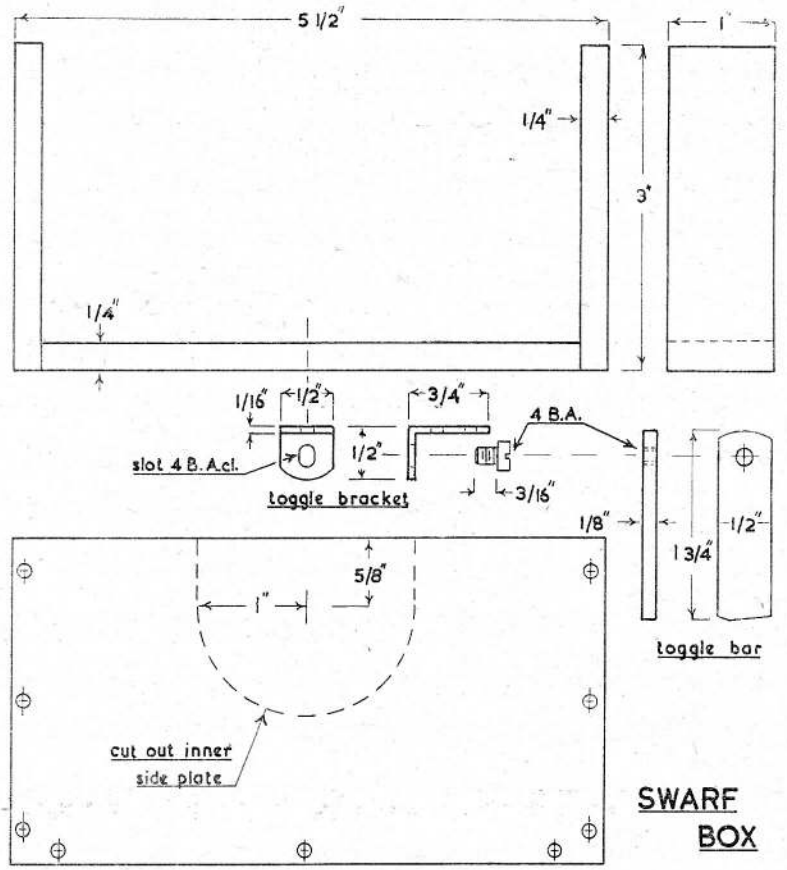


Fig. 21

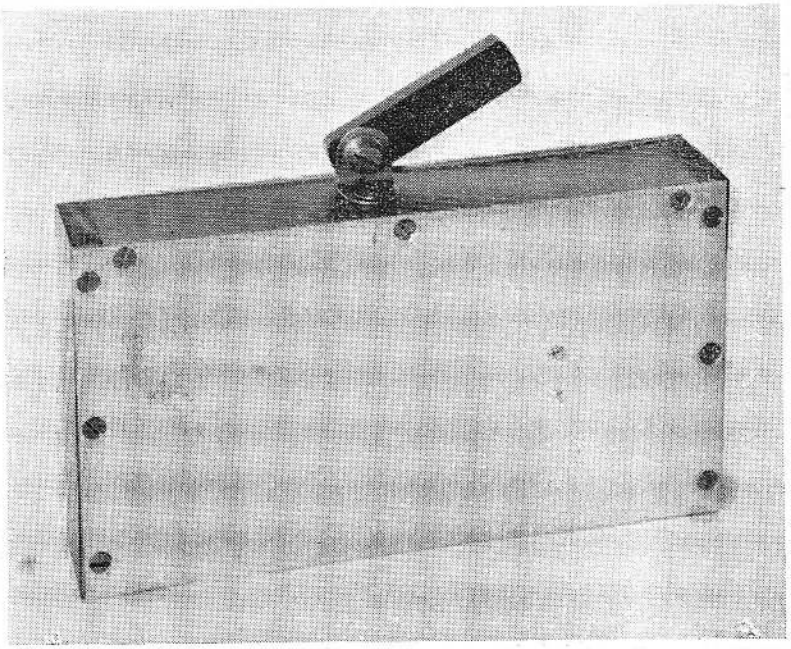


Fig. 22: Swarf box with its toggle lever

set teeth spaced 14 to the inch, about the same pitch as the ordinary tenon saw. Run at moderate speeds, the carbon-steel saw cuts at the same rate as a hand-saw, but it leaves a better and more accurate finish.

For commercial work, circular wood saws are normally run at a surface speed of up to 10,000 ft a minute. By operating a fine-pitch saw at much less speed, accidents to the hands, even if they occur through careless handling, are not serious. The hollow-ground saws used for cutting plastic materials are of high-speed steel and have a tooth pitch of $\frac{1}{8}$ in. with a thickness of 1/32 in. and 0.050 in.

Their teeth have greater strength and are more resistant to wear than those of carbon-steel saws.

A further advantage of using a saw of relatively fine pitch is that there are usually two or more teeth in engagement with the work face of the material; this prevents grabbing, as well as shock, when only a single tooth enters deeply and bears the cutting pressure alone. The conditions are similar to those needed for the efficient operation of a hand hacksaw, where the blade should have teeth of fine pitch for cutting thin material, so as to avoid jamming and tooth breakage. These hollow-ground saws are also suitable for good-working, as they cut freely and leave a high finish even on soft wood; they may save you the trouble of changing saws for a short run.

For accurate working the saw must run truly and without wobble, or at the start it will cut a kerf wider than its own width, and this will spoil the fit of mitred or straight butt joints. Although plastics are left with a smooth, accurate sawn surface, a better finish may be desired for the sake of appearance. The shallow saw marks are readily removed by light draw-filing or by taking a finishing cut in the shaping machine.

The work can be easily polished by rubbing it with a piece of soft cloth, backed by a flat strip of wood and charged with Brasso or another liquid polish. Rub the polishing pad quickly to and fro and apply plenty of pressure, but not enough to heat and damage the surface finish.

Three guide fences have been made for the machine for cross-cutting, ripping, and mitring. They are aligned with the saw and guided by the data edges formed at the front and left side of the saw table—the front side parallel with the axis of the saw spindle and the left side at right angles to it. In this way we get an accurate guidance which does not depend on

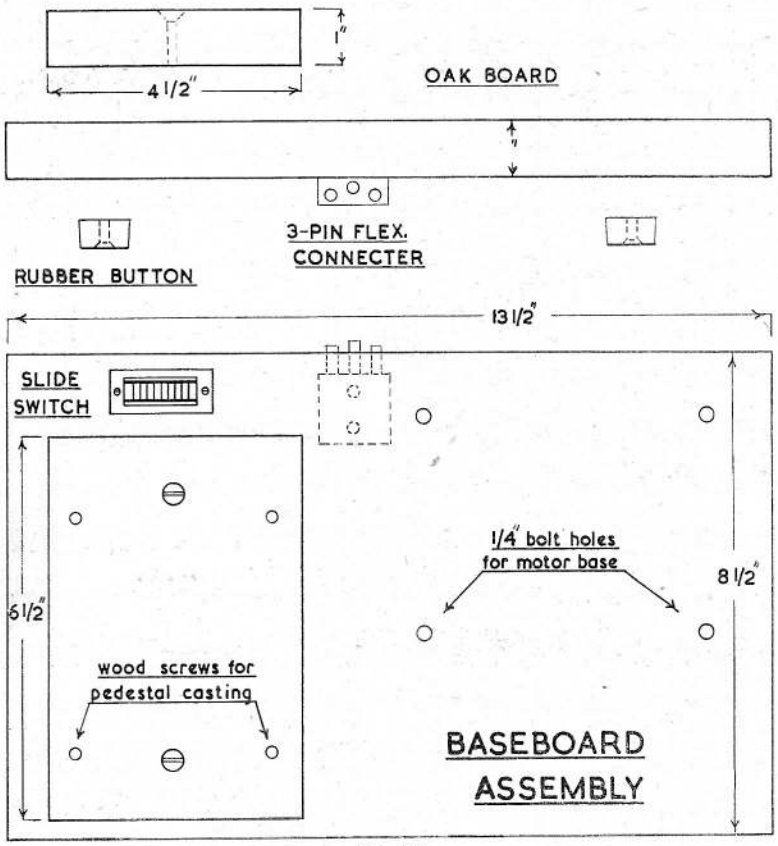


Fig. 23

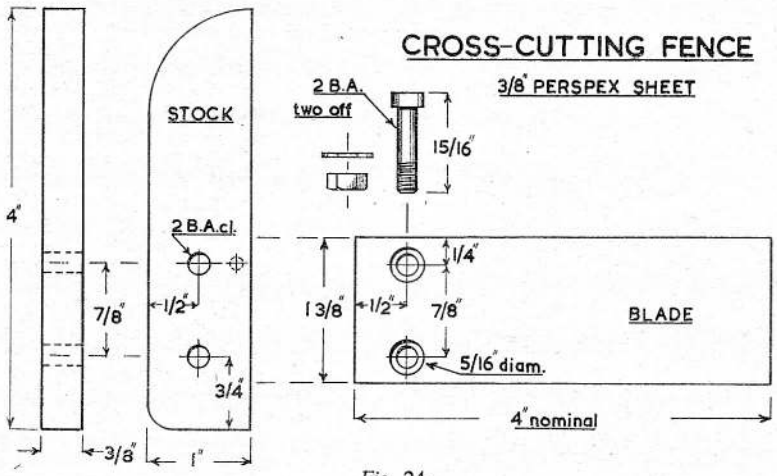


Fig. 24

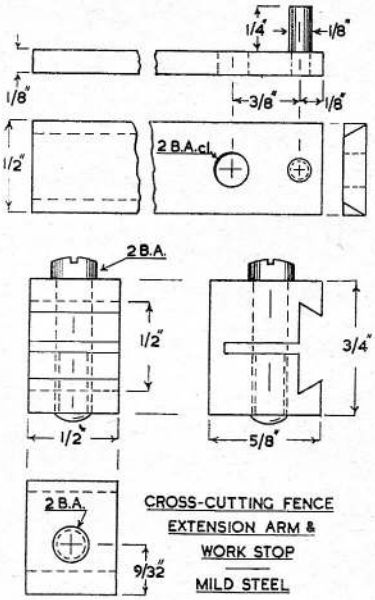


Fig. 25

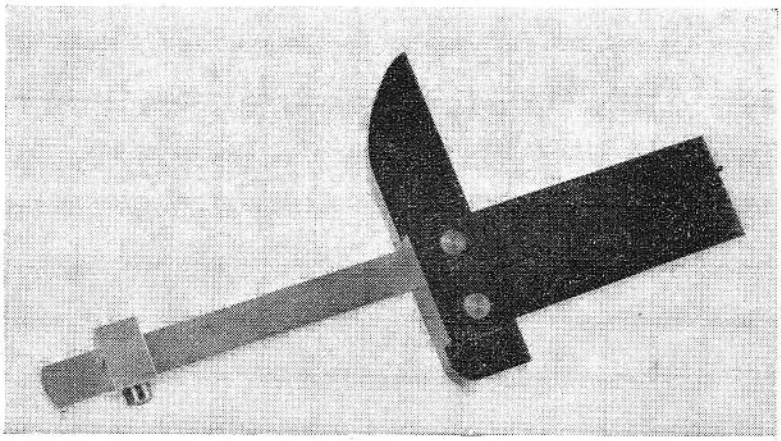


Fig. 26: *Cross-cutting fence with extension arm and work stop*

the shakeless fit of a tenon moving freely in a guide slot.

The machine can now be put to work cutting up the $\frac{3}{8}$ in. Perspex sheet to form the main components of all three fences. A straight-edged strip of wood is clamped to the saw table exactly parallel with the saw and at the required distance from it.

If the cross-cutting fence is made first, it will serve for cutting the parts of the other fences to length. The blade of the fence is left over-length and is afterwards sawn to the finished length when the fence is in the working position on the table. Finish the guide edges of the blade and the stock truly straight before you clamp the two parts together, exactly at right angles, for drilling the holes for the two assembly bolts.

As it is important to secure the blade immovably to the stock, the bolt holes are first drilled with a No 24 tapping-size drill and are then sized with a No 13 drill, so that the 2 BA bolts are a light press fit in the two parts of the fence. An alternative method is to drill the bolt holes to the clearing size, and to tighten the bolts with the blade correctly set. To maintain the parts securely in position, two taper pins are inserted in holes reamed with a standard taper pin reamer. This method has the advantage that the blade can be realigned and afterwards secured by again reaming the holes and inserting fresh taper pins. For the sake of appearance, the bolt heads are left plain and not slotted, but if the bolts are properly fitted they will have no tendency to turn as their nuts are tightened.

In cutting short pieces of material to uniform length, the ripping fence can be set to serve as a work stop.

★ *To be continued on March* 16

A CHEMICALLY HEATED SOLDERING IRON

A NEW soldering iron is heated by a chemical action occurring in the body of the tool. It is, therefore, self-contained and independent of any source of electricity or flame. These properties should make it very useful for such work as repairs to overhead lines or aerials, or for use in small boats or aircraft.

The chemical charge is contained in a steel, shelled cartridge, which is inserted into the iron by unscrewing the tip (as seen in the first photograph), a set of five different interchangeable tips being provided.

The heating reaction is initiated by a trigger in the handle of the iron (second photograph). This reaction is stated to produce 10,000 calories, enabling soldering temperature to be maintained for up to eight minutes, according to the nature of the job. At the end of this period, the spent cartridge must be ejected and the action repeated, if soldering is to be continued.

It is manufactured by Jenolite Ltd, 13/17 Rathbone Street, London W1.

Why every live-steamer is

PROUD OF THE PACIFICS

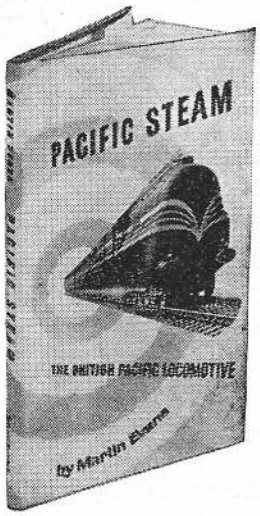
Pacific Steam: The British Pacific Locomotive, *by Martin Evans.* (*Percival Marshall,* 12*s.* 6*d.*)

THIS is an excellent little book. A great amount of accurate technical information is given in an orderly and logical manner, and is combined so skilfully into an interesting narrative that no one, layman or engineer, who loves the steam locomotive should find it anything but enthralling. The text is supported by a large number of illustrations and some data and performance tables.

Martin Evans's book is really a history of the Pacific locomotive in this country from *The Great Bear* of 1908 to the *Duke of Gloucester* of 1954. *The Great Bear* stands by itself, and was before its time; there was no need for it on the GWR of 1908, as the existing Star class was more than capable of anything that might be needed. One can only guess why it was built. Possibly the board of directors wanted it for prestige, and Churchward rather unwillingly agreed. The design had a number of shortcomings which could easily have been overcome, as they were by Stanier some 25 years later when he produced his own Pacific on the LMSR.

The Gresley engine is that rare thing, an original and successful design that has obviously been created as a whole and looks it. True, the valves were too small. They were cramped by the design, but it only needed the Churchward laps and leads to make the performance first class, even with the 180 lb. pressure. A great deal of care was taken with the machinery details. Mr Evans mentions the light nickel-chrome connecting and side rods. There were also the light steel pistons forged in one piece with the tubular piston rods, the sort of thing that should have been put on the two-cylinder *Britannias*—it came with the BR 2-8-0s, but the piston rods were solid. Mr Evans sets out the development which was begun by the 1925 exchange trials with the GWR Castles, and eventually brought forth the A3s with the higher pressure, smaller cylinders and larger superheaters, and the original Churchward valve events which became standard practice at Doncaster.

Further experiments with the A3s showed that they were capable of very high speeds. One test run with *Papyrus* produced a maximum of 108 m.p.h. But when the *Silver Jubilee* express was decided upon, it was thought best to make sure that there would be plenty of power by designing a new class specially for this work. Hence the A4s. With smaller cylinders, larger piston valves and higher boiler pressure, they performed brilliantly on the high speed trains and were quite as good as the earlier Pacifics or the very heavy trains of wartime. Mr Evans is



certainly right when he says that it is doubtful whether the A4s have ever been surpassed as express passenger engines in the United Kingdom.

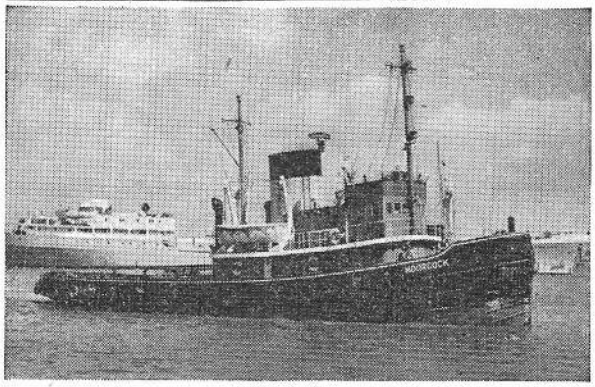
After Sir Nigel Gresley's death in 1941, Edward Thompson, and later A. H. Peppercorn, continued to build Pacifics for the LNER and British Railways at Doncaster. But they had different ideas from Gresley, and although the engines produced by them were capable of good work—especially Peppercorn's—it can hardly be said that there was the inspiration of the A4 design.

The LMS Pacifics, although much later than *The Great Bear*, still bore a strong likeness to it. Its machinery was based on that of the GWR Kings, with the same wheel and cylinder sizes, but the valves were only 8 in. dia. instead of 9 in. The flexibility of the chassis was greatly improved by inclining both sets of cylinders. As turned out, the engines were quite effective, but combustion chambers and larger superheaters much improved the second batch. It was with the streamlined series, and those following, that Stanier produced his masterpiece. As with the LNER, the introduction of the special high-speed trains inspired the revised design which, with its subsequent developments, resulted in a locomotive that could compete on equal terms with the A4.

O. V. Bulleid came to the SR from Doncaster, and it was only to be expected that his thoughts would turn to Pacifics. The design was novel and departed from accepted standards in many ways. From the first the engines were very free steamers and had plenty of power and speed. But many of the novel features soon gave trouble and this, of course, led to criticism—much of it, I fear, because they looked too different to be accepted. This was to be regretted, as the design was progressive. But too many new things were tried at the same time. The locomotives did a great deal of very good work, some of it exceptional, but they were heavy on coal, and the novel valve gear caused so much mechanical unreliability, that they are now being considerably rebuilt. The result is a fine looking machine of a much more orthodox character.

Mr Evans's last chapter is concerned with the Pacifics built for British Railways mainly the robust two-cylinder Britannias and Clans. The three-cylinder *Duke of Gloucester* has the makings of a fine locomotive. The machinery has shown itself very efficient, and one can only hope that extensive experiments may be carried out with it. For those of us who have been following the development of the steam locomotive in these latter days, it would be a very great pity to lose this opportunity.—C.M.K.

Continued from 16 February 1961, pages 198, 199 and 200



FORWARD TO THE FUNNEL

An ME Staff feature

By OLIVER SMITH

Now that a respectable set of davits complete with falls has been fitted to the boat deck, it is only proper that we should take a look at the kind of lifeboat to grace them. I have already mentioned a commercial product, but those who would rather make their own can begin from this week's drawings.

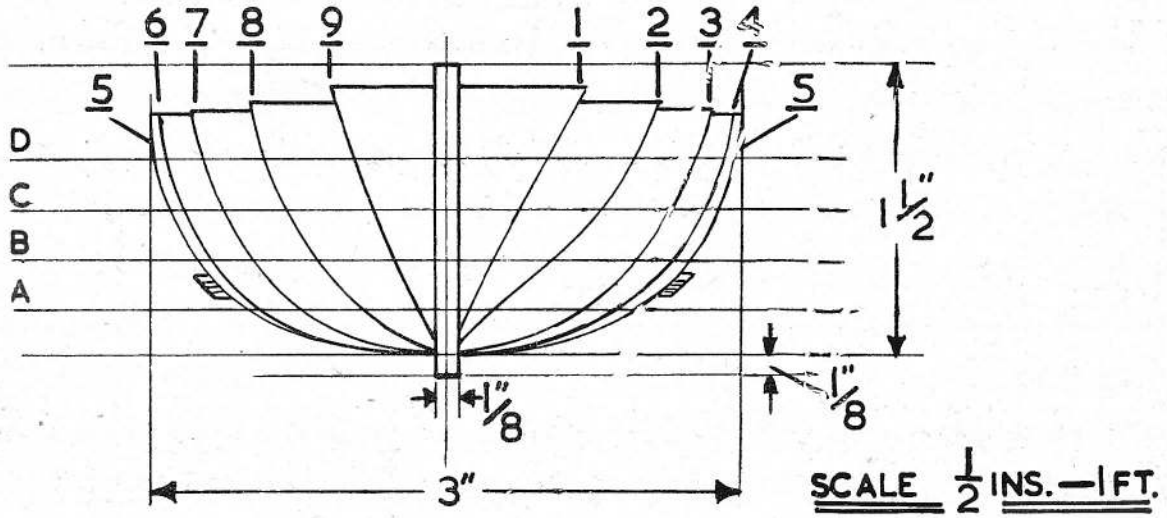
To help in the shaping of the hull to something resembling the correct lines, I have provided two drawings showing the form at different stations. They are printed full-size for the $\frac{1}{4}$ in. and $\frac{1}{2}$ in. scale models. Whatever your scale you can work direct from these pages.

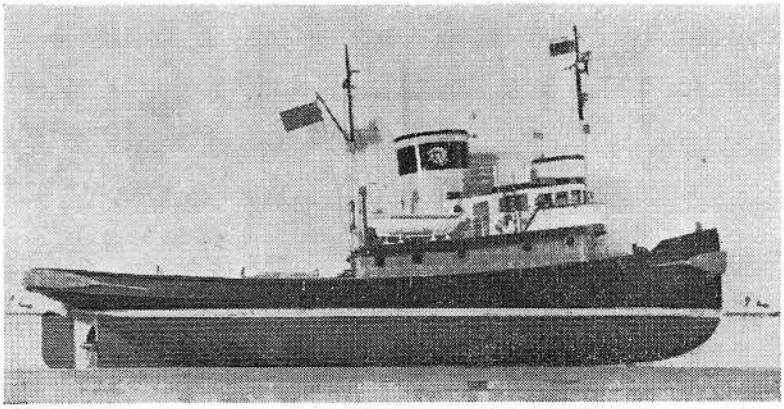
Perhaps those who think quickly as they read are wondering how to do this without defacing their copy of ME. The easiest way is to lay a piece of tracing paper over the drawing and trace round one of the frame lines with a soft leaded pencil. Treat each line with a separate piece of tracing paper, and then paste each piece on to a piece of stiff cardboard. When the paste has had time to set cut round the pencilled line to complete the template. In this way you can make a set of templates without the slightest damage to the magazine.

The next step in making the lifeboat is to cut a piece of wood large enough for the boat to be shaped from it. Rather hard wood with a close grain is to be preferred. First square it up into an oblong shape measuring 4 in. × $1\frac{1}{2}$ in. × $\frac{3}{4}$ in., the overall dimensions for the smaller boat, or twice these sizes for the $\frac{1}{2}$ in. scale. Prepare to mark out the different positions from which to work, beginning with the centre line of the boat and following with the frame stations.

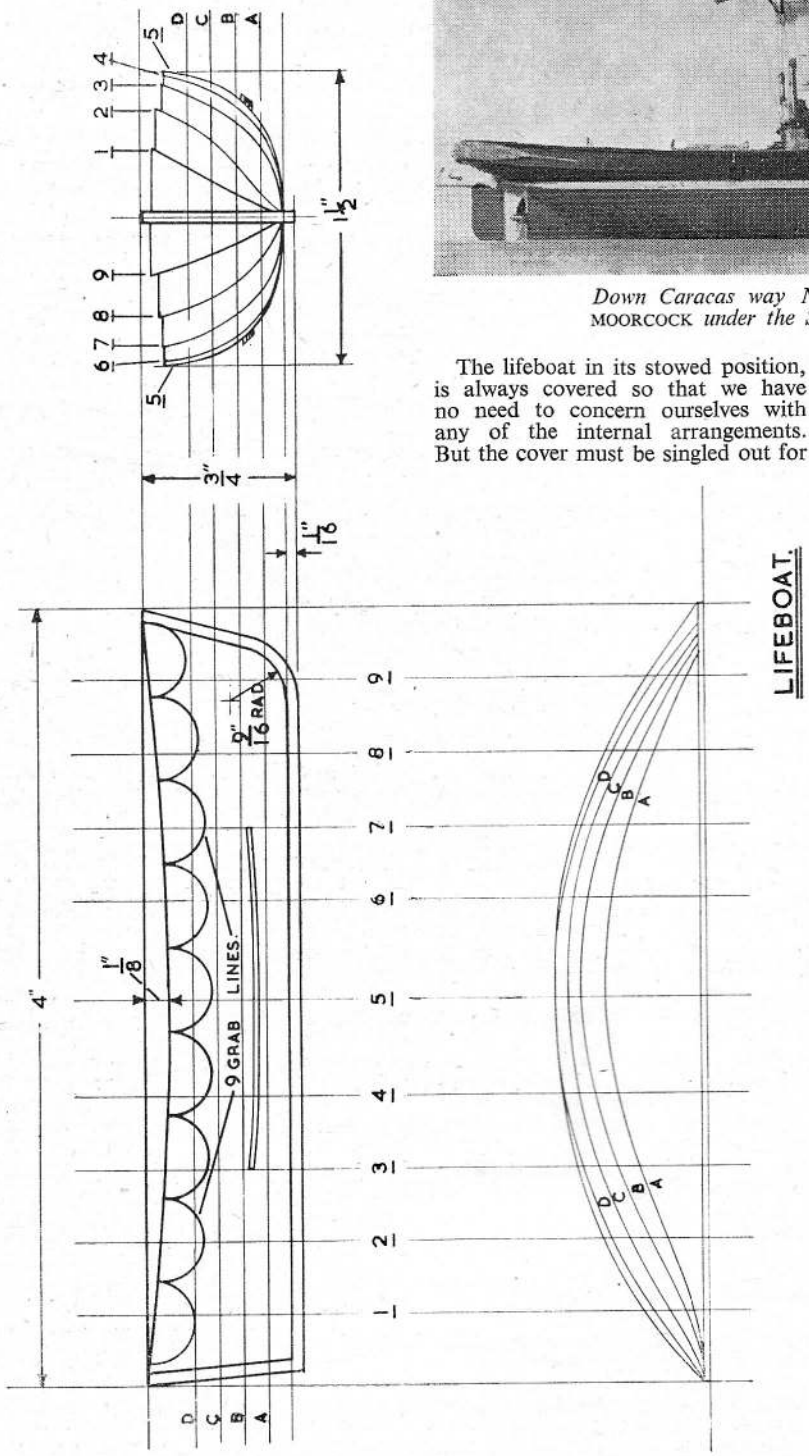
If you have any difficulty in making the lines really stand out on the wood so that they can be easily worked to, you can overcome it by coating the block, before you begin to mark out, with white emulsion paint. Those who have followed this series from the first will remember that I offered a similar suggestion in discussing the making of the wooden former for the hull of the tug. You will find on pages 138 and 139 in ME for 4 August 1960 two illustrations showing the block of wood treated in this way.

The spacing of the frame lines to which the cardboard templates are offered up during the shaping of the hull are $\frac{3}{8}$ in. apart, working forward from the stern, with the exception of Nos 5 and 6, which are spaced slightly further apart at $\frac{1}{2}$ in. Those working in $\frac{1}{2}$ in. scale must not forget to double these dimensions.





Down Caracas way Norman Bailey is building MOORCOCK *under the Spanish name of* RIO GINI



The lifeboat in its stowed position, is always covered so that we have no need to concern ourselves with any of the internal arrangements. But the cover must be singled out for attention if it is to be made all neat and ship-shape like the full size tug in the previous illustrations.

A central support is required, parallel to the keel, so that the tarpaulin can be made to slope away to the sides. It is easily obtained by sloping away the top surface of the block on each side of the centre line until it reaches a depth of $\frac{1}{8}$ in. at each side.

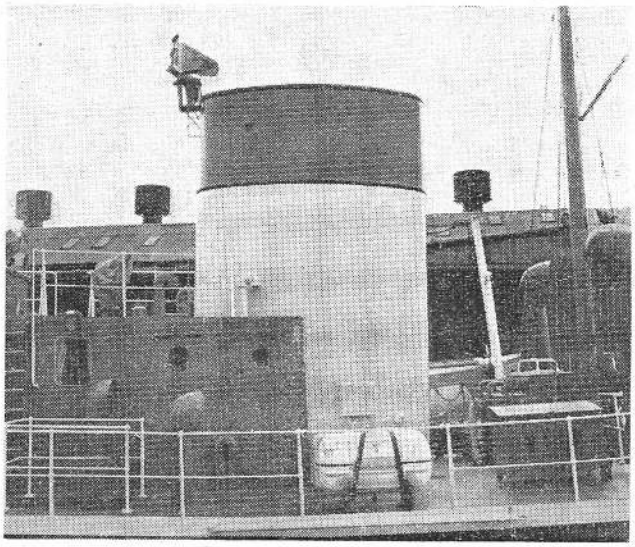
When the finishing touch is applied with a few rubs from a piece of fine sandpaper, we have a surface to meet our needs. The shaping of the hull proper can then begin.

A small gouge is probably the handiest tool to remove the bulk of the surplus material. Follow up with a small rough half-round file to blend in the curves. The final shape is obtained by carefully sandpapering the surface. To complete the hull, glue a thin strip of wood along each side, as in the drawing.

There are seven small spaces to be cut out of the strip before it is fixed to the hull, and because of the size the job tends to become irksome. But by using balsa wood, which can be bought in thin square strips, and by careful manipulating with a used razor blade, together with a little patience, it will not be long before you have it looking just like the real thing.

Your next task is to give the work a coat of white paint. Try to avoid making it look all shiny with the hard mirror surface which results from using enamels. The finished surface should be on the flat side. Water emulsion paint will give an ideal finish.

After the paint, no more is needed but the trimmings ! The grab lines along the port and starboard sides and the tarpaulin cover are often seen painted or drawn in with ink. But I think that, having reached this



Here is MOORCOCK'S *funnel from the port side*

stage, we should finish our little boat off in the correct manner.

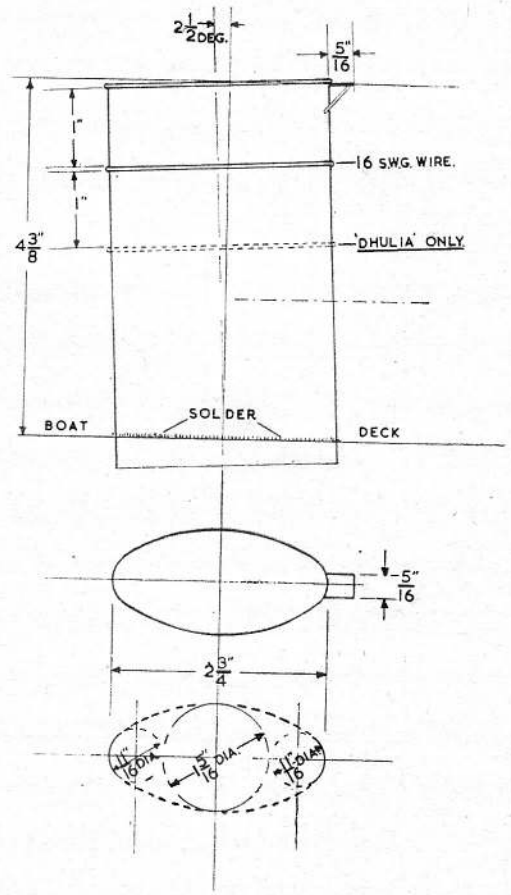
There are nine holds or loops to each grab line. Fine rigging cord meets the needs well and is simply fixed to the boat by applying a dab of adhesive at the top of each loop.

The tarpaulin cover is the last touch of realism to be added. A piece of material from a needlework basket would possibly be just the thing. Ask for it tactfully and the owner of the basket will quite likely make the cover for you ! It should be a dark olive green.

Stow the boat in the davits and fix to the davit arm the chocks in which it rests when it is in position.

We turn to the funnel, a part of such importance that it is often the factor which decides whether a model is to be built or not. I do not think anyone can complain about *Moorcock* on this score. She has a most handsome funnel, proportioned to blend in harmoniously with her general lines.

The funnel of *Dhulia* is exactly the same in shape and size, and the only difference is the extra metal band running round the funnel as a dividing line in the colours of the funnel markings. At the end of the series I will deal with the colours in which both tugs are painted, but no doubt you would like to know the colours of the funnels now. *Moorcock* has a thick black band at the top, down as far as the metal band, and the remainder is painted a light blue; *Dhulia* has an all black funnel with a red band and the colours are divided, as in *Moorcock*, by the band of metal. The spacing of the colours is shown on the small drawing; they are correct to full size.



FUNNEL.

Making the funnel does not present any major problem. A piece of brass or copper tube, or a tin such as contains metal polish, can be pressed into service. A neat oval shape is obtained by squeezing the sides of the tube in the jaws of a vice or, if the gauge permits, by hand. Another method which is often favoured is the forcing of a hard-wood former through the piece of tube.

When the funnel has been shaped, it is held down on the boat deck and a line is scribed round it for removing a portion of the deck to allow part of the funnel to pass through. The centre should be 3½ in. from the after end of the boat deck. Make the funnel a tight fit into the deck and try to keep it as neat as possible so that a generous fillet of soft solder can nestle into the corner without fear of its falling through any gaps.

A keen follower of this series is Mr Norman C. Bailey of Caracas, Venezuela who has recently sent me a photograph of his version of *Moorcock* with the Spanish name of *Rio Gini*. Apart from the fact that it appears to be a first-class model, I was particularly interested because it has risen from a plastic kit bought more than five years ago. Generally plastics have little interest for me as such, and I am inclined to frown on them as models. I always feel that 95 per cent of the interest in actually making something has been left on the toolmaker's bench and not in the kit. But at the same time I am not so dogmatic as to deny that it can sow the seed of really serious modelling. Such a kit as the one bought by Norman Bailey is, I feel, a good example of this. Although Mr Bailey does not claim his model to be a perfect reproduction of *Moorcock*, he tells me that it will be by the time that the series is complete.

The model is 34 in. long with an 8 in. beam, is powered by an electric motor, and is radio-controlled. Mr Bailey's one regret is that he knows no one in his corner of the world with whom he can share his interests; and so if there is a shipmate lurking near the port of Edf Gibele No 3, Calle Paris, Las Mercedes, a hearty welcome awaits him.

★ *To be continued on March* 16

KEEPING TO PLAN

It is not too late to start work on that project for the coming season

HOWEVER strong one's intentions, it is not always possible to keep to a programme. Some enthusiasts who planned to build a new boat for the coming season may well have had their ambitions thwarted. Illness, an unexpected change of job, or moving house can all put paid to even well-conceived plans.

But to those who have suffered this frustration life is not quite so black if the project which they had in mind is not too involved. It is still possible to construct a model yacht or simple power boat in time for a 1961 outing.

In the current Working Drawings Catalogue (price 3d., or 7d. by post) published by Percival Marshall Ltd there are several designs of simple model yachts, which can be attempted in a short space of time.

For the more ambitious there is *Debonnaire* (catalogue No. SY 27) which was specially designed by H. E. Andrews for radio control. It has a length of 6 ft, beam of 13 in., and draught of 15 in. Total weight is 21.18 lb.

Two sheets are published. Sheet 1 gives the deck and body plan; sheet 2, the sheer plan, half breadth plan, diagonals and curves of areas. Each is 7s. 6d., or the two may be had for 13s. 6d. Prices include post and packing.

Debonnaire is an exceedingly sensitive yacht, and has an exhilarating turn of speed. She has two sail plans —for fair or adverse weather—and even with the storm sails set it was noticed, when the prototype was secretly tested at an open-air swimming bath, that she displayed a lively turn of speed. She has another rare quality: she sailed a point closer to the wind than was expected.

For power boat men who delight in speed the new hydroplane *Comet*, the characteristics of which were described recently by Edgar T. Westbury, offers fascinating possibilities.

The hull lines for constructing this newcomer are given on plan No PB 28, price 4s. 6d.

Representing the other extreme of power boats is the *Himalaya*, an excellent model of the P and O liner designed by C. J. Sawbridge.

It is drawn to a scale of $\frac{1}{16}$ in. to the foot, which provides a model 44½ in. overall, 4 in. deep and with a beam of $5\frac{7}{16}$ in.

Sheet 1 gives the general arrangement, waterline, and details of all the decks and the bridge. Painting instructions are included. Price is 21s.

Sheet 2 shows the rudder, stern frame, derricks, king post, davits, funnel, swimming pool and winches. Price 4s. The set (No PB 24 in the catalogue) may be had for 24s.

Percival Marshall plans are produced to a good standard, but the plans for *Himalaya* are exceptional. Considering the first-rate model which can be produced from them they represent excellent value.

Those who delight in taking their model boats to the local ponds on Sunday mornings may be interested in two new plans drawn by Mr Westbury.

One of them is of a carburettor and the other of a contact breaker, both for his famous *Kiwi* engine. Each plan gives the general arrangement and full details of the item. The carbuettor is listed under PE 12, and the contact breaker under PE 17. Price of each is 2s. 6d.

In the locomotive field there are two new additions.

Martin Evans has designed a slide valve and valve gear for the 5 in. *Springbok* (LO 28, price 3s. 6d.) and also a twin ram mechanical lubricator (LO 30, price 3s. 6d.).

All the above plans may be had by return of post from Percival Marshall Ltd, 19-20 Noel Street, London W1. Prices include postage. In the event of any query please write to the Plans Service.

With the exception of *Debonnaire*, none of the plans discussed here is listed in the printed catalogue. They will, of course, appear in the next edition, which is being prepared at the moment. ▣

FOR YOUR BOOKSHELF

Famous Railway Engines of the World. (*Percival Marshall Ltd.*). *Price* 1*s.*

THE mighty articulated locomotive of North America, the elaborate 2-10-0 mineral engine of Soviet Russia, and Britain's own incomparable King class are among the subjects dealt with in the latest addition to Percival Marshall's series of popular booklets.

For ease of reference, a simple layout has been adopted. A half-plate size picture of the engine occupies the left-hand page, with the relevant text on the right-hand one.

There are 32 pages of good quality paper. The price is 1s., or 1s. 2d. by post.

A Fortnight in Sweden (*Percival Marshall Ltd.*) *by C. E. Waller. Price* 5*s.*

LAST year Mr C. E. Waller, Executive Editor of Percival Marshall publications, visited Sweden.

He was greatly attracted by the beauty of the country and hospitality of the Swedes. The outcome of this was another title in the " Fortnightly " series.

To those who are thinking of Sweden as a holiday venture, Mr Waller's book is a useful guide.

All the information that a stranger to the country needs is between its covers, carefully compiled in relevant chapters.

SIRENA . . .

Continued from page 262

even slight weeps, with soft solder. All the silver-soldering required on this boiler can be done with a two-pint blowlamp and by packing the parts round, to retain the heat, with some coke or broken firebricks. I prefer firebricks as they do not burn away, but coke has the added advantage of providing some heat. Sometimes I have also obtained the little extra heat by standing the small boiler on a ring of the domestic gas stove. With the additional heat from the gas ring, the small blowlamp can often deal successfully with jobs which would otherwise be beyond it. Of course, the gas ring should not be turned up so high that the parts already silver-soldered come adrift. Photograph No 10 is a near-side view of the engine without any of the superstructure and with the chimney removed from the boiler.

★ *To be continued on March 16*

READERS' QUERIES

DO NOT FORGET THE QUERY COUPON ON THE LAST PAGE OF THIS ISSUE

This free advice service is open to all readers. Queries must be of a practical nature on subjects within the scope of this journal. The replies published are extracts from fuller replies sent through the post: queries must not be sent with any other communications: valuations of models, or advice on selling cannot be given: stamped addressed envelope with each query. Mark envelope clearly "Query," Model Engineer, 19-20 Noel Street, London W.1

Resin

Could you direct me to a firm who can supply common resin, to mix with pitch for turning purposes ?—L.F., Nottingham.

▲ *It should be possible to obtain resin through any local oil and colour stores.*

Sail plan for Prospero

I have an old PM publication, *Model Sailing Yachts*, Marshall's Practical Manual No 4. It shows a picture of the A class boats of the International Race of 1927.

Twenty years ago a great friend of mine built a very fine model of the schooner *Prospero*. I am anxious to acquire a sail plan that would rig her as a sloop, as the schooner rig is altogether too clumsy, and the sails are home-made.

I would be also glad to know of a good model yacht sailmaker. I used to get mine from a Mr Drown, but I do not see his name any more.

With best wishes for 1961.—T.C. Cork.

▲ *You might be able to rig your ship from sheets* 2, 3 *and* 4 *of SY.*25. *These are from the plans for* MYRMIDON, *a sloop of the late* 18*th century. If this is not suitable, I suggest you write to Harold Underhill of Underhill Plans, Baltonsborough, Glastonbury, Somerset.*

For sails you could contact Mr Roberts of 14 *Saxon Road, Hove, Sussex.*

Valve gear for traction engine

I am building a 3 in. scale traction engine, and I am not sure of several points.

Working pressure is 60-80 superheated. Would you tell me the dimensions of the slide valve, and the required throw of eccentrics ? How can I get the correct radius of the radius link for the Stephenson link motion ? Thanking you for all you have done.—C.B., Holmfirth, Yorkshire.

▲ *If you have sufficient room in your steam chest, the exhaust ports should be at least* $\frac{1}{2}$ *in. wide and all ports at least* $\frac{3}{4}$ *in. long, if not* 1 *in. With a lap of* $\frac{1}{8}$ *in., valve travel in full gear would be* 1 *in.*

Possibly $\frac{3}{16}$ *in.* $\times$ $\frac{3}{4}$ *in. steam ports, with* $\frac{3}{8}$ *in.* $\times$ $\frac{3}{4}$ *in. exhaust ports, would suit you better. Valve travel would then be* $\frac{3}{4}$ *in. in full gear, and the throw of eccentrics* $\frac{3}{8}$ *in. for launch-type links. The radius of the link would be the length of eccentric rod plus the distance between the centre line of the link and the eccentric rod pin centre.*

Santa Fe oil-fired model

I am building a 1 in. scale, 5 in. gauge model of an AT & SF 2-8-2 class 3160, and I wish to construct the boiler for oil-firing. Would you be good enough to let me know where I can get more information on the subject other than that which is contained in *The Live Steam Book* or *Manual of Model Steam Locomotive Construction* ?—P.W.H., Worcester.

▲ *There seems to be no other book on the subject of oil firing for models.*

The design of the boiler could follow normal practice for coal firing. Tubes could be spaced at a pitch = diameter by 5 : 4. *A combustion chamber with plenty of water tubes would probably be advisable.*

Marine boiler

I have completed a model centre flue marine boiler, similar to the Bassett-Lowke model. But I have been having trouble with the blowlamp side of my plant.

The blowlamp is of my own design —a pressure chamber made of copper tube $3\frac{1}{2}$ in. dia. $\times$ $2\frac{1}{2}$ in. depth. I have fitted it with a hand pump to pressurise the chamber. A piece of $\frac{1}{8}$ in. internal dia. tube (copper) leads the lighting fluid (paraffin) to a Primus pre-heater and nozzle. Attached to this I have a flame tube, which transfers the heat to the boiler.

My problem is how to keep the blowlamp working. As I cannot retain a pressure in the fluid chamber, every two or three minutes I have to pump more air into it. This I feel is wrong. The hand pump is not leaking, nor the filling cap. The rest of the joints are perfect. I have thought of fitting an adjusting valve to control the flow of paraffin, but I cannot think of a suitable design, or I cannot see anything suitable in the Bassett-Lowke catalogue. Should there be a control valve in the system ? The flame tube itself turns red hot after only a few moments operation, and this part of the blowlamp's function is perfect.—J.M., Garelochhead, Dumbartonshire.

▲ *Your trouble may be leakage from the hand pump. Even a slight leak here will prevent the burner working.*

Another possibility is that your jet is too large for the size of the pressure container; it may have become enlarged.

A screw-down valve between the pressure container and the burner would be a useful addition. It should have a fine thread and an acute angled point.

Young men's project

I am interested in developing among the apprentices doing their basic workshop training in our apprentice training school a sense of craftsmanship for its own sake, coupled with a deeper sense of artistic and cultural values, whether the things which they are making are functional or not.

Towards this end, I want them to make an article covering some, if not all, of the basic bench and machine tool exercises (centre lathe, milling, shaping and grinding) with a preference for a united effort that engages the attention of the whole group.

I have toyed with the idea of making a grandfather or grandmother clock, examples of which I have followed in MODEL ENGINEER. Although I still consider this an idea for the future, I estimate the time factor to be rather beyond the capabilities of the apprentices (12 on a bench and eight on machine tools) when it is considered that their training has lasted only five weeks, and I want to finish a project by the second week in May (about 16 weeks). As the project will be presented to the chairman of the board of directors of the company I want it to be of a very high standard and functional to some degree.

I wonder if you could tell me what would be suitable?—W.F.S.M., Pontypridd, Glamorgan.

▲ *As time seems to be an important factor, the most satisfactory project for your apprentices would be a loco-*

motive chassis complete with cylinders and valve gear.

It would have the advantage of providing a wide range of skills for the boys and would be an excellent demonstration model to present to the chairman of the board of directors. The boiler fittings, cab, and either tender or tank, depending on the type of engine you select, could be added at a later stage if desired. Bearing in mind that the project has to be completed by the second week in May, your choice should be restricted to an 0-4-0 *or* 0-6-0 *tank locomotive.*

I am enclosing our Working Drawings Catalogue in case it is of some use to you. Perhaps you would let me know what success attends your plans.

Removing scale

I would be grateful if you would tell me of a product to take the scale off the inside of a 7¼ in. gauge copper locomotive boiler without harming it.—J.M., Andover, Hampshire.

MODEL ENGINEER EXHIBITION

The next Model Engineer Exhibition will be held at the Central Hall, Westminster, opposite Westminster Abbey, from 16-26 August 1961, excluding Sunday. An announcement about entry forms will be made later.

▲ *Provided that all fittings are removed from your boiler, any kettle cleaning fluid could be used.*

It is important to wash out all traces of the cleaning fluid before reassembly.

Building the Big Boy

I am intending to build a 4-8-8-4 *Big Boy* in 2½ in. gauge. On such a small scale would it be advisable to fit Baker valve gear ? The cylinders will be about 1 in. bore × 1¼ in. stroke.

I want to use a boiler pressure of 80-100 p.s.i. Could you please tell me what the gauge tubes should be ?

Will a mechanical pump be required as well as the tender hand-pump ?

I intend to use an oil-fired boiler. The firebox is quite long and wide, but rather shallow.

The wheels I am going to use are 2$\frac{13}{16}$ in. for the coupled and driving wheels, but they are spoked. I would like wheels of the American pattern. On the full size engine, I think, the front 4-8 wheels are fixed directly to the boiler or smokebox. At the front this frame could be up to ¾ in. deep. The tractive effort should be about 80 lb. I wonder if you could estimate the hauling capacity ?

This will my first effort, but I think all that is needed is twice as much patience than one needs to build a rather simpler job. I think an engine of this type is wanted to give a good performance in 2½ in. gauge. My only real worry is the live steam and exhaust pipes which are quite long, rather tightly bent, and painted in places. Their internal diameter may have to be enlarged. —C.R.L., King's Lynn, Norfolk.

▲ *There is no reason why Baker valve gear should not be used for your ½ in. scale Mallet.*

For a boiler barrel 3½ *in. dia.* 16-*s.w.g. would be advisable.*

A mechanical water pump would be essential for a model of this size. Hauling capacity should be 6-12 *adults.*

You are being a bit ambitious in making such a big and complicated engine as a first attempt.

Caledonian single-wheeler

I am engaged in the construction of an O gauge fine scale version of the Caledonian single-wheeler No 123, and I find myself at a loss for information on one or two small points which I feel are nonetheless important.

The locomotive is being built in its original form, as supplied by Neilsons, with the original tender, which should place it at about 1887, before the standard Caledonian tender was adopted (in 1888, I believe).

I am working from a good collection of photographs, an ME drawing by J. N. Maskelyne, an O gauge Williamson drawing, and an article by JNM from the *Model Railway News* of January 1933. I have mounted the two sections of the *ME Library of Locomotives* which deal with No 123 on a sheet of card, protected with pliofilm and have found a wealth of useful information in them, notwithstanding that it is the present-day version.

Are there two injectors ? What is the type of firebox door—circular, oval, or butterfly ? Which is the type of valve gear ? It appears to be Stephenson. Are the steamchests above or beneath the cylinders ? Does the tender handbrake column emerge from the offside sandbox ?

It is my intention to attempt working motion work as the gap between boiler and frames is too obvious and prominent to ignore; hence my desire for information not shown on most drawings and photographs.

I am hoping to enter this model in the next National Models Exhibition, and as much remains to be done there is an urgency flavoured with desperation in this request !—L.W.J., Blackheath, Birmingham.

▲ *The firedoor of No* 123 *appears to be of the drop-down type, the opening being rectangular with rounded corners.*

There were two injectors, and Stephenson valve gear was used. The valve chests seems to have been arranged between the cylinders.

The tender handbrake column would appear to emerge from the right-hand sandbox.

MTB builds MTB

I am replacing a 5 c.c. motor in a 52½ in. motor torpedo boat, with a 10 c.c. McCoy 60 glow-motor. Could you please give me the correct propeller size, flywheel size, and weight ?

As the motor is convertible to a petrol engine, could you say what type of contact breaker and equipment is needed for the conversion ? The cam for the breaker is integral in the crankshaft of the motor.

My reason for changing the motors is that with the 5 c.c. engine the model will move at a fairly correct scale speed of around 2½ to 3 knots. Although this may be correct in theory, the boat will not plane, and in my eyes a power boat that does not lift like the full-size one is not worth bothering about.—M.T.B., Isleworth, Middlesex.

▲ *It is generally necessary to carry out some experiments to find the correct size and pitch of propeller to suit the particular boat with a given engine power, as there are so many variables that the exact sizes cannot be determined by calculation.*

You might try a propeller of 2 *in. dia. by about* 4 *in. pitch as a basis for further experiment. A suitable flywheel for this engine would be about* 2½ *in. dia.* × ⅝ *in. wide on the face. To avoid excessive weight, the flywheel should be mainly concentrated in the rim, and the rest, except for the hub should be lightened as much as possible.*

Without exact details of the engine, it is impossible to advise you on the exact type of contact breaker required. You may be able to adapt one of the designs published in ME, such as the KIWI *contact breaker which was recently described. It should be pointed out that obtaining the highest performance from any type of model power boat is largely a matter of experiment, and that it is impossible to lay down hard and fast rules.*

POSTBAG

The Editor welcomes letters for these columns. A PM Book Voucher for 10s. 6d. will be paid for each picture printed. Letters may be condensed or edited

THAMES LAUNCHES

SIR,—I think you will find that the launch illustrated in Postbag of December 1 would be one of two paddle steamers that used to ply between London and Hampton Court —*The Queen Elizabeth* which had a white funnel, and *The Cardinal Wolseley* which had a buff coloured one.

I remember their coming down the river by Ravens Ait at Surbiton when I was a young schoolboy.

Epsom, Surrey. W. HUNTER.

E.T.W.

SIR,—May I use a little of your space to express my appreciation of Mr E. T. Westbury's letter in Postbag of January 26 ? It could hardly have failed to enhance the esteem in which he is held by so many readers.

In all humility, I would like to elaborate on the theme of the latter half of his letter. I believe that completely destructive criticism is rare, but where it does exist it by no means follows that it springs always from ignorant minds; on the contrary very often an intellect capable of great work can be obsessed with the suppression of ideas distasteful to itself.

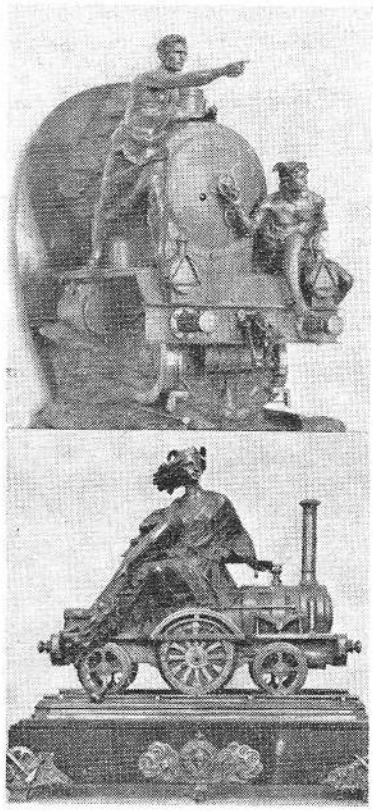
History tells us how progress in science, medicine and engineering had to fight against the experts of the day. The unfortunate fact is that great achievements in any field can still leave room for a petty side to a man's nature.

Mr Westbury has the answer to this in his expressed philosophy. He knows he can be wrong; he enjoys being right; he disagrees with some people's ideas, but respects the other man's right to hold them. In other words he is charitable and tolerant. I am sure that it is a very human trait to resent criticism. Quite often the reasons for resentment are unworthy ones; the criticism is less regarded than the critic. That *he* should dare to speak after the pundits have pronounced !

Not all of us, alas, have Mr Westbury's insight into our own natures, but if we can judge all arguments and people on their merits and not on their weaknesses, and definitely not on our own failings, we shall go far to achieve a complete understanding of each other.

I sometimes feel that mankind is becoming a little too arrogant. I am certain that over-sensitivity to criticism, if not on the increase, is still too great for a reasonable sane adult society.

Oldham, Lancs. R. Moss.



Two pictures from a Paris reader who collects clocks and watches. Top: A clock made to celebrate the opening of the Simplon. A 230 PLM 2-4-0 (series 2600) emerges from a tunnel carrying the figures of Mercury and Industrial Progress. Above: Clock of the Second Empire. The 1-A-1 was inspired by the Stephenson engines of 1846-49. Both clocks are in the Mueson di Rodo, Uzes

RAILWAY TIME

SIR,—A few years ago I started collecting watches and clocks of railway interest. I enclose two postcards of two of them, which are on exhibition at the Museum di Rodo in Uzes.

I have but little knowledge of what exists in museums and private collections in that field, and I would appreciate if any reader could give me some information on books or collections dealing with clocks and watches with railway subjects or ornaments.

Rue Chardin, HENRI GIROD-EYMERY.
Paris.

ATLANTIC ARMS ?

SIR,—On the way to my home in Darlington I pass a public house whose windows are unusual. There are two large ones, one on each side of the door, and etched in the glass is a full window-length Belpaire-type boilered Atlantic and tender. I take it to be one of Worsdell's Atlantics.

At the side of the building are two more etchings of the engine, partly head-on and partly from the side. The detail work is remarkable.

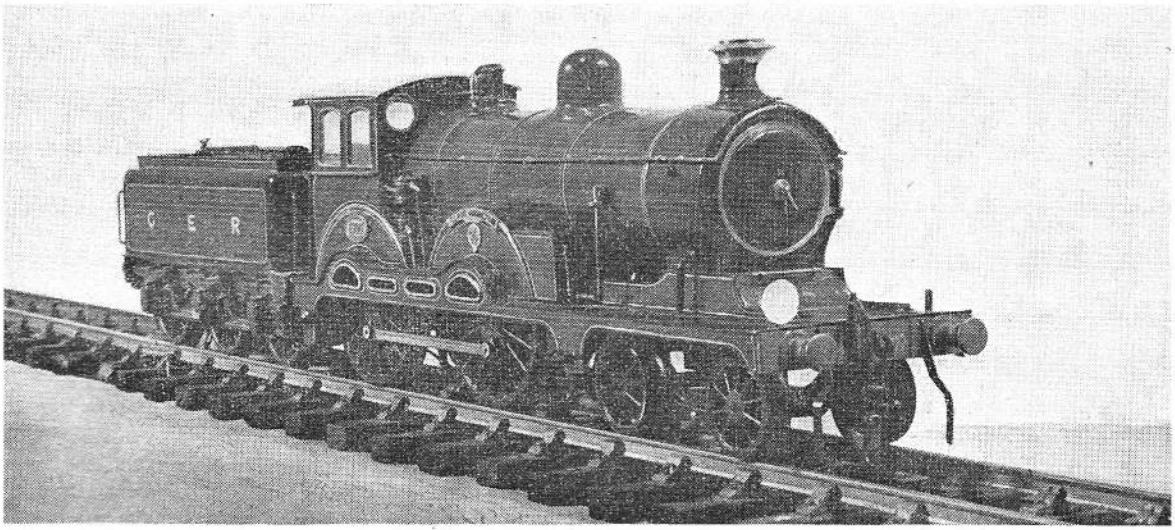
Darlington. J. H. GLADDEN.

HIGH SPEED ENGINE

SIR,—I think it likely that the design of the high-speed engine and dynamo in Postbag of 8 December 1960 is the one which won the ME competition in 1902 for a direct-coupled high-speed engine and dynamo set. The design was for an enclosed compound direct coupled to a four-pole dynamo of 750 watts output. It was made by Messrs F. L. and F. P. Spicer. For the period it was very much an up-to-date design. It was a totally enclosed compound engine with forced lubrication, piston valves to both h.p. and l.p. cylinders, and enclosed governors acting on a throttle valve. Cylinders were $1\frac{3}{4}$ in. and $2\frac{1}{2}$ in. bore $\times$ 2 in. stroke.

In Vol. 9, July-December 1903, there is a design for a direct coupled set of 500 watts capacity with, in this case, a single-crank tandem compound enclosed engine.

This was, I think, the second prize



J. R. Smith of Nottingham runs a blue-liveried CLAUD HAMILTON *on his O gauge outdoor track*

winner, but in my opinion, not nearly such a good design as the winner.

It was by Mr A. Foulds, and the series commenced in the issue for November 19th. In the original design there was an error in the valve arrangement and the late E. L. Pearce, in the issue for 17 December 1903 suggested a remedy. The valve design was a weak point, the valves being circular slide valves, not true piston valves and unbalanced.

Rustington, K. N. HARRIS.
W. Sussex.

GAUGE O

SIR,—As an ardent admirer of the old Great Eastern, I was heartened to read in Smoke Rings for January 19 of the preservation of the Holden 2-4-0 No 490. The Holden's were delightful little engines, and I am sure that this restoration will be warmly appreciated by a large number of enthusiasts, particularly as such elaborate pains have been taken to restore No 490 to her original splendour. Does not this emphasise the more tragic fact that none of the Claud Hamiltons have been preserved in their original condition—those super-splendid members of an elegant caste ?

The letter in which Mr J. P. McKenna [Postbag, January 19] refers kindly to the " Clauds " evoked my immediate sympathy. I have a splendid model of *Claud Hamilton* in 7 mm. scale. As I am not the builder, I can add without lack of modesty, that it earned highly commendable comments from J. N. Maskelyne.

My picture shows the engine on my outdoor O gauge layout. Unfortunately the black and white does poor justice to the lovely blue finish and brasswork.

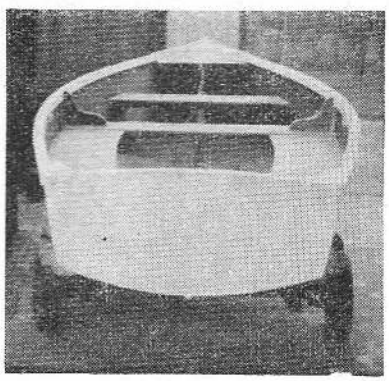
Nottingham. J. R. SMITH.

OUTBOARD

SIR,—I thought your recent article on outboard engines interesting, and I hope you will follow it up with an ME outboard—perhaps steam ? There was the ME motor-cycle of 1901, and so why not the ME outboard of 1961 ?

As I had wanted a boat for some time, last summer I made up a kit which I had from Taunton. For the power unit I have used an old Villiers 150 c.c. motor-cycle engine.

Handsworth, T. W. BIRCH.
Sheffield.



With a kit from Taunton, a Sheffield reader built a boat to which he has fitted an old 150 *c.c. motor-cycle engine*

PARAFFIN

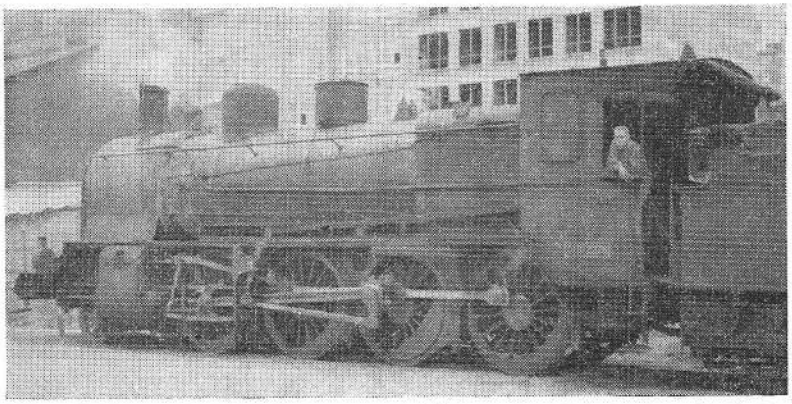
SIR,—The question about a blowlamp flame [Queries, 15 December 1960] and your reply seem to illustrate the paucity of published information on the subject. For small boats, some locomotives and stationary engine models paraffin is a cheap reliable fuel, and if burnt correctly gives out an amazing amount of heat. Over the past five or seven years I can remember only two articles in the ME on successful designs.

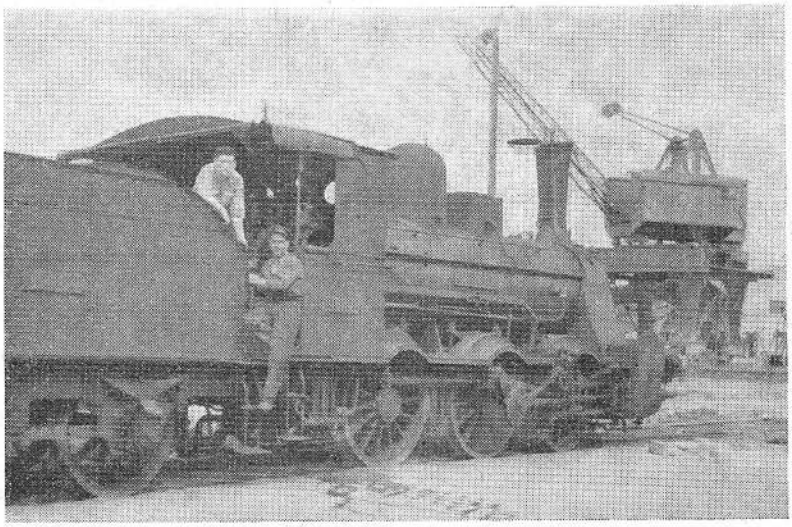
For eighteen months I have made a variety of such burners, some successful and others quite the opposite. From each failure one learns a great deal, and the satisfaction in making a really successful burner, with a wide range of control, is considerably. In fact making blowlamps can become quite a mania !

I would imagine that G.C. of Colne is suffering from too high gas velocity, which is blowing out the flame. His statement that a smaller jet makes the trouble worse seems to confirm this view. I have cured such a condition by reducing the pressure of fuel in the tank or the volume of air entering the nozzle and of the flame tube. A slight constriction on the front end of the flame tube is certainly helpful, but it must be adjusted in accordance with the air regulation.

I would also suggest that a No 80 size hole in the nozzle is quite large, and I would reommend a 0.010 in. dia. hole as a better starting point to ensure complete combustion.

Kingsbury, T. H. MALLETT.
London.





Steam at Corunna (where they buried Sir John Moore). Top: 4-8-0 *freight engine with boiler by Babcock and Wilcox. Above:* CERVANTES *dock shunter. Is there, perhaps, a* ROSINANTE *somewhere in the country of Don Quixote?*

AT CORUNNA

SIR,—I enclose a few pictures of locomotives taken at Corunna in Spain. Large numbers of steam engines are still in use and do valiant work hauling ore trains over the mountains, double-headed as shown.

Dock and station shunters are nearly all incredibly old. A few years ago we saw a Single at Algeciras, with "Beyer-Peacock 1895," on its paddlebox.

Model engineering does not appear to flourish, although there is no shortage of small engineering shops. Very few model trains are to be seen in the shops, and the only good piece we saw was a small scale casting of a locomotive fettled and burnished and costing £5, which is about £15 by local standards.

West Weybridge, Surrey. K. R. NORTHGREAVES.

MEMORIES

SIR,—I was much interested in Martin Evans' article "I Remember the Old Great Eastern" as I was a schoolboy living near the sea marshes, and went to Coppermill Road School in the mid-Nineties. I am now 76 and am building the 3½ in. *Jubilee*.

I remember the old LNWR engines with Joy valve gear, and I listened to the chatter of the slides when they were running free with steam off—or was it a snifting valve? I could never be sure.

Many years ago I built an 0-6-4 tank with modified Joy gear. It worked; but the 1914 war stopped any further investigation into performance and steam economy.

My grandfather and father were both in the Brighton shops of the LBSCR a long, long time ago.

Salford, Lancs. S. N. SHURMAN.

0-8-0s AND 2-8-0s

SIR,—I was interested to read Mr Langridge's short article on the LNWR 0-8-0s versus the S and D 2-8-0s, although the results do not surprise me.

Joy valve gear can give a reasonable steam distribution when the engine is in good condition; the cast-iron wheels and "humpy" coupling rods would not of course affect performance.

The big-boilered 0-8-0, which was later adopted, had Walschaerts valve gear, though I very much doubt whether any of these three locomotive types would have a chance if pitted against a Churchward 28XX 2-8-0—an earlier design by at least four years.

London W1. MARTIN EVANS.

SERVICE

SIR,—May I just write a few words to thank you for your prompt reply to my query of last week about the supply of a bar magnet of an unusual size?

I am sure you will remember recommending that I should write to Messrs Darwins Ltd, Sheffield.

This I did, and today I received a letter from the assistant manager of the magnet department promising to supply one of the size required, already magnetised, of 35 per cent cobalt magnet steel.

This is exactly what I need, and once again I would like to express my gratitude for your prompt help.

Birkenhead. H. J. ROBERTS.

JUNGLE GIANT

SIR,—The portable shown in Postbag of 18 August 1960 could easily be an early Marshall 6 h.p. threshing engine. Back in 1922 I recovered a similar engine from the jungles of Assam, retubed and cleaned it up, and set it to drive a saw bench. It had been lying unused for ten years or more and so must have dated from about 1900. The rectangular section guide bars and the vertically disposed feed pump are characteristic of this engine.

I was interested to read of the Wantage engine [Postbag, 22 September 1960] as I served my apprenticeship at the works—unfortunately after the makers had discontinued engine building. But the tradition was still strong. I am ashamed to confess that I cannot construe the motto although the meaning of the individual words is clear.

Nyasaland. T. GIBBARD.

Mr Gibbard's inability to construe the Latin motto will not earn him a hundred lines of Virgil; the words are unconnected and the motto is meaningless.—EDITOR.

CLUB NEWS

Send news and notices to The CLUBMAN, 19-20 Noel Street, London, W1.

CHESTER'S PROGRESS

CHESTER Model Railway Club has moved to more suitable and comfortable surroundings. It now meets at Chester Northgate Station, where the workshop has been re-equipped with new machines and tools.

A 50 ft length of 3½ in. and 5 in. gauge live-steam track is laid indoors for testing and for teaching new members the mechanics of model steam locomotives and how to drive and maintain them.

For those who just like to sit around and talk, the room is far more comfortable than the old premises. New members can be welcomed on cold evenings with the knowledge that a blazing fire and a mug of steaming tea await them.

Details of meetings may be obtained from the secretary, Mr S. Campbell, 15 Hight Street, Runcorn, Cheshire.

WELSH WIZARD

As museums demand quality and accuracy in their models, any model engineer who manages to have a model exhibited in one of them should feel proud. Mr Lionel Heath of the St Mellons MES has just had four of his magnificent models accepted for the National Museum of Wales. They are models of contractor's wagons and carts.

St Mellons MES is a progressive society. Readers will no doubt remember the opennig of the multi-gauge track. This year three new locomotives will run on it: a fine *Jubilee* by Mr Edward Coe, a 5 in. gauge Andrew Barclay of the Beckton Gas Works system, built by Lionel Heath, and a *Pansy* built by the chairman of the club, Mr Cyril Goulding.

The St Mellons MES exhibition is to be held from April 1-8 at Stow Hill School, Newport. It is hoped to have 400 models on exhibition. Why not have one of yours there? Mr J. J. Constable, the secretary, will be pleased to give you details. His address is 28 Routh Court Road, Cardiff.

ROCHDALE TRACK

The multi-gauge track of Rochdale SMEE is now approaching completion. It provides for locomotives of 2½ in., 3½ in. and 5 in. gauges. From the photograph sent to me by secretary Thomas Brooks, it is one of the most pleasantly situated tracks in Britain.

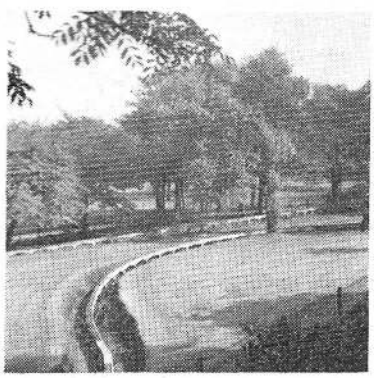
A length of 700 ft is made up of a 200 ft straight, a very large radius curve and two curves of 40 ft radius. The whole track is built on concrete arches. All that remains to be done is to build the steaming bays and arrange the drainage. Then all will be ready for the official opening this summer.

The track is easy of access. It is laid out beside the main Bury-Rochdale Road just inside the Rochdale-Heywood boundary, and it can be reached easily by car and bus. A frequent bus service operates along the road.

One locomotive sure to run this year is Mr L. Woolfenden's 3½ in. gauge LMS Duchess class 4-6-2, which was awarded the Locomotive Trophy of the club. Another locomotive which will be seen on the track is Mr H. Smith's GWR Hall class 4-6-0 *Lykeham Hall* winner of the second trophy. Some time in the future members can expect to see a model of GWR City class 4-4-0 *City of Truro* showing her paces.

Advance news: Rochdale SMEE exhibition will be held at Lea Hall, Smith Street, Rochdale from December 6-8 inclusive.

Secretary: Mr T. Brooks, 27 Rodney Street, Castleton, Rochdale.



CLUB DIARY

March 2 Huddersfield SME. Mr E. Horsfall will talk on Building an L5 Tank in 5 in. gauge at the Highfields HQ at 7.30 p.m.

March 2 Romford MEC. Bits and pieces evening at the Red Triangle Club, Romford at 8 p.m.

March 2 Harrow Wembley SME. Lecture on photographic processes at Heathfield School, Harrow at 8 p.m.

March 2 Eltham and District Locomotive Society. Lecture by Mr Hatherhill on his quarter size industrial locomotive at the Beehive Hotel, Eltham at 8 p.m.

March 3 Welling and District MES. Annual meeting at the Welling Library at 8 p.m.

March 3 Greenwich and District SMS. Talk by Mr S. Baines on his model "Turmoil."

March 4 Bristol SMEE. Meeting at the Mary Room at the YWCA.

March 4 SMEE. Visit to LTE Signal School, Earls Court.

March 4-5 North Eastern Railway Society. Meeting at the Granby Hotel, Scarcroft Road, York.

March 5 West Riding Model Power Boat Association. Annual meeting at the Unitarian Schoolroom, Back Lane, Wakefield at 3 p.m.

March 7 City of Leeds SMEE. Traction engine night.

March 9 Rugby SMEC. Films by the P. & O. S.N. Co.

March 10 Thames Ship Lovers' and Ship Model Society. Lecture by Mr Bathe of the Science Museum on re-housing and re-setting the ship model collection.

March 11 SMEE. Lecture by Mr R. Hardy, motive power superintendent BR Stratford Depot, on "Railway Experiences" at 28 Wanless Road, London SE24 at 2.45 p.m.

March 11 York SME. Talk on crystals by Mr Hearfield at the Rechabite Buildings, Clifford Street, York at 7 p.m.

March 13 Clyde Shiplovers and Model Makers' Society. A talk by Mr D. McDonald on Some Clyde Built Clippers at the Kelvingrove Museum and Art Galleries.

March 13 Historical Model Railway Society Impromptu meeting. Members are requested to bring models photographs, etc., for display and discussion.

March 13 Sutton Coldfield N. Birmingham MES. Work in progress at the Swan Inn, High Street, Erdington.

March 14 City of Leeds SMEE. Visit to Airedale Works to see Mr T. O. Hunts's Burrell traction engine.

March 15 Birmingham SME. Annual meeting at the White Swan Inn, Edmund Street at 7.30 p.m.

March 16 Bristol SMEE. Meeting at the Mary Room of the YWCA.

March 16 Romford MEC. Lecture on taps and dies by Mr J. Lane at the Red Triangle Club, Romford at 8 p.m.

March 16 Harrow and Wembley SME. Film night at Heathfield School, Harrow at 8 p.m.

March 17 Greenwich and District SMS. Talk by Mr A. E. Randall on painting ship models.

March 18 Malden SME. Annual Dinner at the headquarters, Claygate Lane, Thames Ditton.

March 17 Welling and District MES. Meeting at the Welling Library at 8 p.m.

March 18 SMEE. Rummage Sale at 28 Wanless Road SE24 at 2.45 p.m.

March 18 Thames Group Marine Modelling Society. Open night at the Reindeer Hotel, Wakefield Street, Gravesend at 7.45 p.m.

March 19 Railway Enthusiasts Club. Rail tour of LSWR suburban area behind Adams 4-4-2T Radial. Relive the era before electrification. Tickets 25s. each from Mr A. P. Miall, "Hurstbourne," Wainsford Road, Everton, Lymington, Hants.

March 21 Northampton SME. Film show at the Kingsthorpe Community Centre at 8 p.m.

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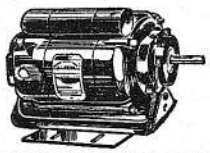

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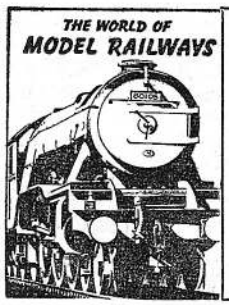

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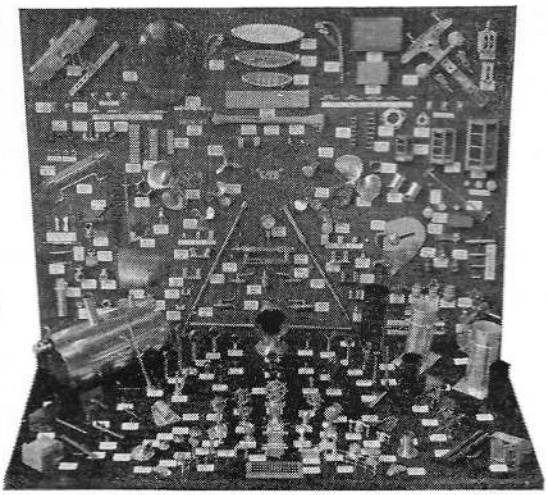

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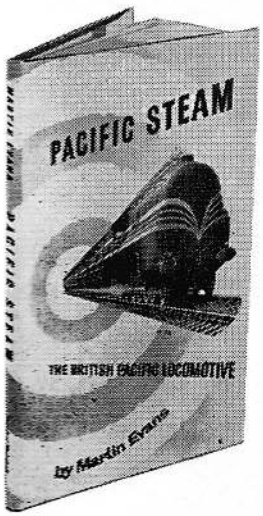

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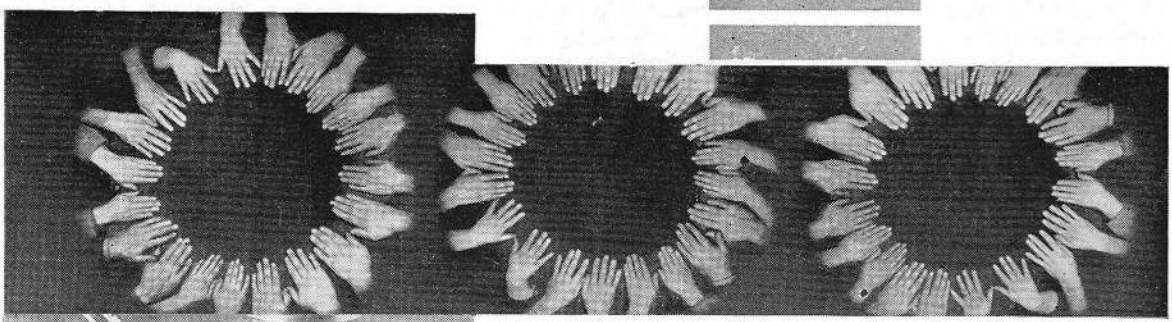

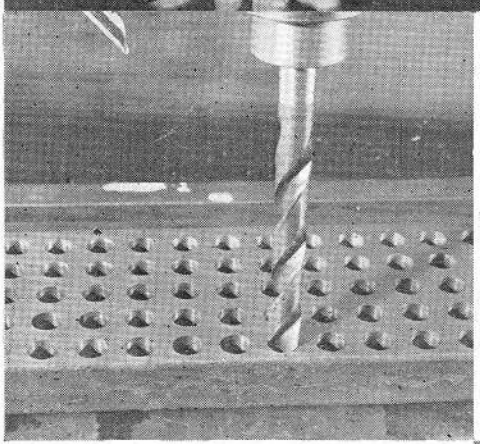

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